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VOL. XII. NEW YORK, AUGUST 18, 1888. No. 7.

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Berliner's Gramophone. ALTHOUGH only a few months have passed since we described the gramophone, improvements have been made, such that what was formerly a comparatively tedious process, is now converted into one requiring but a short space of time, namely, the production of a solid plate bearing the sound record. Our description in another column shows the simple manner in which the vibrations of the recorder are permanently engraved, and experiments which we have ourselves witnessed give evidence of the fact that Mr. Berliner's method of reproduction will find extended application, one of its principal advantages being the readiness with which the reproduction can be effected.

Standard Indicating Instruments. WE describe in another column an indicating instrument which is said to be a long step in advance in the application of exact measurements to every-day work. It would almost have been deemed beyond the bounds of possibility a short time ago that a "portable instrument," in every sense of the word, could be designed which should measure a difference of potential by reference to a Clark standard cell, the recognized standard of E. M. F., yet such has been actually accomplished in the apparatus of which we give a description. With such an instrument at hand, there is now afforded an absolute standard of comparison, independent of all ordinary changes to which instruments dependent upon most other principles are subject, and the electric light inspector is enabled to distribute the lamps of proper voltage with an absolute certainty of their being in the right place.

The Volta Prize. AFTER a competition lasting for five years, the Committee of the French Chamber and Senate have decided to award the Volta prize of 50,000 francs to M Gramme, for the improvements made by him in the construction of dynamo-electric machines. We need not here recall the well-known history of this invention, but it is gratifying to know that the inventor of the machine, which has probably more than any other brought electrical applications into prominence, and especially electric lighting, should be placed by the side of Faraday, Ampère, Ruhmkorff and Bell, among the former recipients of the prize. The commission has done well in awarding the prize to M. Gramme, who has always been a hardworking and modest man, but has, we believe, been little recompensed, considering the widespread and general introduction of dynamo machinery as the result of his efforts in the production of the continuous current machine.

Electric Lighting in London. ANOTHER evidence of the improvement in electric lighting matters in England is to be found in the formation of the Metropolitan Electric Supply Company, whose operations in the field of electric illumination are to be on the most extensive scale. Several old plants will be taken over, and new ones will be equipped. The management of the company will be very strong, the various departments being officered from men in the front rank. Sir John Pender, himself a tower of strength, is financially interested; Sir William Thomson and Dr. John Hopkinson will be the consulting engineers, and Messrs. J. E H. Gordon and J. B. Verity will be members of the board. If we might offer a suggestion it would be that the company do not confine itself to lighting. In such a city as London there should be an excellent demand for electric motive power, and there are good motors in England, such as the Immisch, to meet all the requirements, while we can also send some first-class motors from this country.

The Electric Light Association. As the time draws near for the summer meeting of the National Electric Light Association, the signs of activity become numerous and promise a very largely attended and successful meeting. The exhibits will, it is feared, not be so plentiful as they might be, from the fact that the hotel accommodations will not allow of large machinery displays or of extensive shows of supplies; but, on the other hand, the location is central and convenient, and the hall in which the sessions will be held is spacious and airy. Already the indications are that a number of important topics will be discussed, and we can assure our electric light readers who have not yet attended these gatherings that they will be well repaid for the time and trouble if they come to New York to learn how their brethren fare in the business. Besides the direct benefit enjoyed, there are the incidental pleasures of social intercourse, and although the city itself may be hot, the river and the sea are near by for solace and relief. We think that the New York meeting will be a memorable one, and all who can should make it their business to be present. With the telephone convention coming the week after, the city will be even more than usually attractive to electrical folk.

The Edison Convention. ON another page will be found a report of the proceedings of the Edison Convention held last week at Nantasket Beach. Although the privacy of the proceedings debars us from making as full a report as we would like to give, it will be seen from the outline that the work was throughout of a useful and practical nature. It would be interesting to have the arguments presented in the discussion that was held on the alternating current and the three-wire system, but we must perforce be contented with the statement made, of a fact very obvious to all who were present, that the Edison delegates were far more cheerful as to the situation than they were six months ago, and that they were avowedly quite ready to accept the new and onerous conditions which a very sharp and vigorous competition had forced upon them. We are glad, through the kindness of the author, to present a portion of the admirable paper, by Mr. W. J. Jenks, on lightning and the protection of stations from it. Both the practical and theoretical parts—even what some might call the visionary part—are full of interest, and we trust that Mr. Jenks will follow up the subject. Altogether the convention seems to have been a decided success. We venture to express the hope that when the Kansas City meeting is held, the association may see its way to throwing open its doors during some of the sessions.

Government Telegraphs Abroad. THERE is an opinion prevalent in this country that the government telegraph systems of the Old World are not particularly profitable. The opinion is borne out by the statement of a special committee on the English Post-Office Telegraphs. The estimates of the service show a continuous growth in expenditure and in the proportion of expenses to gross income. The last annual deficiency is not far from $2,500,000. Various reasons are given for the steady deficit, and one of note is that the press dispatches are handled at a loss of nearly $1,000,000. Another reason is the old one of the high price originally paid for the telegraphs. Over against this exhibit may be set the Western Union returns, which point to a dividend of 7 or 8 per cent. on the immense and well-watered stock of the company. Evidently private control, regarded from the standpoint of earning and profit yielding, is not such a bad thing; and though the cry for government control is still kept up we fail to see wherein the service of the American monopoly is not at least equal to that of the English monopoly. Moreover, under the provisions of the new Senate bill putting the telegraphs under the care of the Inter-State Commerce Commission, there is guarantee of a just and full protection of public interests. As we predicted long ago, practical legislation on the subject will take this shape, and it is significant that in the Senate the bill has practically passed without opposition.

Lightning Arresters. NOTWITHSTANDING the long time that the lightning rod has been applied to the protection of buildings, and the arrester in the telegraph and similar work, there still seems to be lacking a well recognized and efficient means of protecting dynamo machinery from the effects of lightning We do not mean to say that there is no lightning arrester in use which will protect electric lines: but it seems from the very latest investigations that there are things to be taken into consideration which have heretofore not been recognized as necessary. These new researches emphasize the value of the work done by Professors Hughes and Guillemin many years ago, in which they showed that the best form of lightning arrester was the flat ribbon. Taken in connection with the more modern experiments which show that the flow of current starts at the outside of the wire, and requires some appreciable time to equalize itself over the whole cross-section, and also with the fact of the infinite rapidity of the discharge, it follows that apparatus to be effective for lightning protection must deal with all these points. In the paper read before the Edison Association, Mr. W. J. Jenks takes up several of these points, and shows in what manner they may be provided for. The frequency with which we hear of the damage caused by lightning in electric light stations seems to make such an inquiry eminently timely, and we hope that the results arrived at by the Edison Standardizing Bureau will lead to some plan of protection which may be generally applied. While much can be gained by the use of experimental apparatus in such investigations, it must not be forgotten that the vagaries of lightning are too great to enable any general rule to be formulated excepting after extended trial and experience.

Rascality by Telephone. INSPECTOR BONFIELD, of the Chicago police, has been burdened by the *Herald* of that city with a most extraordinary story as to a blackmailing feat performed there with the aid of the telephone. It is stated that a well-known and rich member of the Board of Trade was called up on his private telephone, from his residence in the suburbs. On going to the instrument he was surprised to receive the information that his interlocutor was a burglar who had bound and gagged his wife, the cook, the chambermaid and the negro coachman, and who instead of ransacking and setting fire to the house was ready to accept $20,000, the said sum to be paid over to a "pal." At that minute a stranger presented himself in the office, supplying what Pooh Bah calls "corroborative detail," and the broker sending his submission over the line, at once handed out two bundles of $10,000 each, which the stranger took and instantaneously disappeared with. Thereupon the broker proceeded home in a hurry to give comfort to his sorely beset household, only to find upon his arrival that he had been badly victimized. He reported the case to the police, but no trace has been obtained of the confederates or their booty. Such is the story. Our readers can believe it if they wish, though in doing so they are not likely to entertain in future a very high opinion of the nerve and presence of mind of the members of the Chicago Board of Trade, a body which hitherto has had credit for some fertility and quickness of resource. Besides, there are a few apocryphal points in the narrative, and it may be that the Chicago police inspectors are simply practicing on guileless reporters with a view to serious work in joint authorship with Julian Hawthorne, like their confrères of New York. It is singular, however, that we hear so little of practical joking and downright fraud with the assistance of the telephone, and the only inference can be that the service does not by any means as easily lend itself to such purposes as might be supposed.

Experiments on Induction Coils.—IV.

BY DR. LOUIS DUNCAN, CARY T. HUTCHINSON AND GILBERT WILKES, JOHNS HOPKINS UNIVERSITY.

Most of the mathematical solutions corresponding to the experiments that have been given have been already worked out. One case, however, that is of some interest has not been solved; it corresponds to an induction coil whose primary is supplied by an alternating current, with a condenser interposed in the secondary circuit. The general equations are:

$$M\frac{d\,I'}{d\,t}+L\frac{d\,I}{d\,t}+R\,I-E=0. \qquad (1)$$

$$M\frac{d\,I}{d\,t}+L'\frac{d\,I'}{d\,t}+R'\,I'+V=0. \qquad (2)$$

Where M = mutual induction of primary and secondary;
L = self-induction of primary;
L' = self-induction of secondary;
R = resistance of primary;
R' = resistance of secondary;
I = current in primary;
I' = current in secondary;
V = difference of potential of coatings of condenser;
C = capacity of condenser.

Also, $E=E_0\sin\frac{2\pi}{T}\,t=E_0\sin a\,t$;

$$I'=C\frac{d\,V}{d\,t}=C\,D\,V;\ (D=\frac{\delta}{\delta\,t}).$$

$$V=\frac{1}{C}\,D^{-1}\,I'=K\,D^{-1}\,I';\ (K=\frac{1}{C}).$$

Substituting and putting the simultaneous equations (1) and (2) in symbolic form:

$$(L\,D+R)\,I+M\,D\,I'=E_0\sin a\,t \qquad (3)$$
$$M\,D\,I+(L'\,D+R'+K\,D^{-1})\,I'=0 \qquad (4)$$

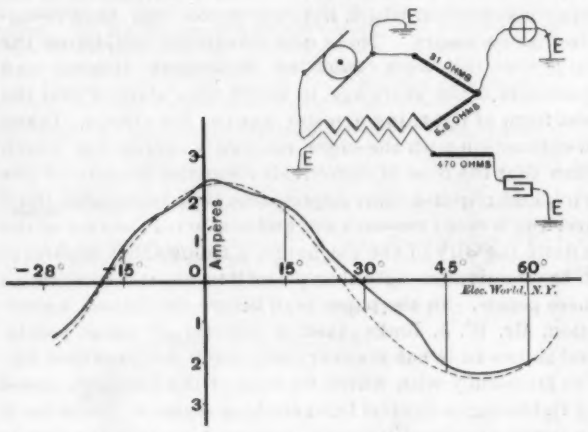


FIG. 1.—EXPERIMENTS ON INDUCTION COILS.

Putting $[(L\,D+R)(L'\,D+R'+K\,D^{-1})+(M\,D)^2]=F(D)$.

$$F(D)\,I=D\cos a\,t+G\sin a\,t \qquad (5)$$
$$F(D)\,I'=H\cos a\,t \qquad (6)$$

Where $D=E_0(a\,L'-\frac{K}{a})$; $G=R'\,E_0$; $H=-a\,M\,E_0$.

The general solution of (5) and (6) consists of a particular integral and complementary function.

The complementary functions,—since $F(D)$ is linear,—are:

$$I=A_1\,\varepsilon^{\rho_1 t}+A_2\,\varepsilon^{\rho_2 t}+A_3\,\varepsilon^{\rho_3 t} \qquad (7)$$

$$I'=B_1\,\varepsilon^{\rho_1 t}+B_2\,\varepsilon^{\rho_2 t}+B_3\,\varepsilon^{\rho_3 t} \qquad (8)$$

Where ρ_1, ρ_2, ρ_3 are the roots of

$$\rho^3\,(L\,L'-M^2)+\rho^2\,(R\,L'+R'\,L)+\rho\,(R\,R'+K\,L)+K\,R=0.$$

Since $L\,L'>M^2$, the roots of this equation are negative, and the values of I and I' represent dying out terms which need be not further considered.

For the particular integral we have

$$I=\frac{1}{F(D)}\left\{D\cos a\ t+G\ \sin\ a\ t\right\}$$

$$=\frac{1}{F(D)}\,N\sin(a\,t+\alpha); \qquad (9)$$

where $D=N\sin\alpha$; $G=N\cos\alpha$; $D^2+G^2=N^2$.

Let $I_1=\frac{1}{F(D)}n\cos(a\,t+\alpha)$; then by ordinary method of solution by development of functional operators, we have, after reductions:

$$I=\frac{n}{\lambda}\sin\left\{a\,t-(\beta-\alpha)\right\}=A\sin 2\pi\left\{\frac{t}{T}-\varphi\right\}; \qquad (10)$$

$$I'=\frac{H}{\lambda}\sin\left\{a\,t-(\pi_2+\beta)\right\}=A'\sin 2\pi\left\{\frac{t}{T}-\varphi'\right\}; \qquad (11)$$

$$V=\frac{H}{C\,\lambda\,a}\sin(a\,t-\beta)=V_0\sin 2\pi\left\{\frac{t}{T}-\varphi''\right\}. \qquad (12)$$

The last terms are given so as to better compare the results with the solutions for a somewhat similar case worked out by Mascart and Joubert.

Substituting the values of H, N, λ, α and B and reducing, putting

$$r'=R+\left(\frac{2\pi}{T}\right)^2\times\frac{M^2\,R'}{R'^2+\left(\frac{2\pi}{T}\right)^2\left\{L'-\left(\frac{T}{2\pi}\right)^2\frac{1}{C}\right\}^2} \qquad (13)$$

$$e'=L-\left(\frac{2\pi}{T}\right)^2\times$$

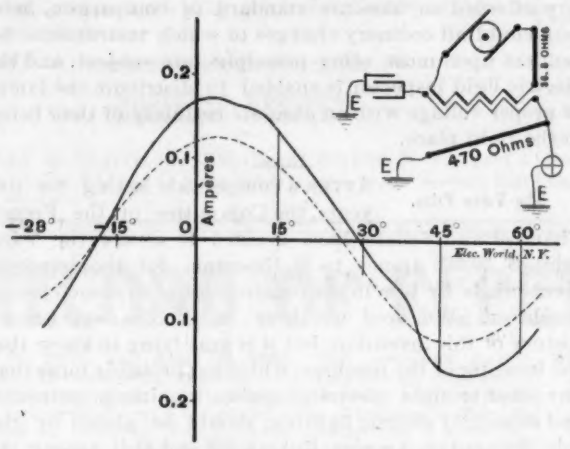


FIG. 2.—EXPERIMENTS ON INDUCTION COILS.

$$\frac{M^2\left\{L'-\left(\frac{T}{2\pi}\right)^2\frac{1}{C}\right\}}{R'^2+\left(\frac{2\pi}{T}\right)^2\left\{L'-\left(\frac{T}{2\pi}\right)^2\frac{1}{C}\right\}^2} \qquad (14)$$

Calling A the maximum value of the primary current, and A' that of the secondary, we find:

$$A^2=\frac{E_0^2}{r'^2+\left(\frac{2\pi}{T}\right)^2 l^2}; \qquad (15)$$

$$\tan 2\pi\varphi=\frac{2\pi}{T}\frac{l'}{r'}; \qquad (16)$$

$$A'^2=\left(\frac{2\pi}{T}\right)^2\frac{A^2M^2}{R'^2+\left(\frac{2\pi}{T}\right)^2\left\{L'-\left(\frac{T}{2\pi}\right)^2\frac{1}{C}\right\}^2} \qquad (17)$$

$$\tan 2\pi\varphi'=\frac{T}{2\pi}\times$$

$$\frac{\left(\frac{2\pi}{T}\right)^2\left\{L'-\left(\frac{T}{2\pi}\right)^2\frac{1}{C}\right\}l'-R'\,r'}{\left\{L'-\left(\frac{T}{2\pi}\right)^2\frac{1}{C}\right\}r'+R'\,l'} \qquad (18)$$

$$V_0^2=\left(\frac{T}{2\pi}\right)^2\frac{A'^2}{C^2} \qquad (19)$$

$$\tan 2\pi\varphi''=-\cot 2\pi\varphi'. \qquad (20)$$

It is interesting to compare these results with the values of the same quantities when there is no condenser in the secondary, the circuit being simply closed on a resistance. In this last case we have (to select a few of the quantities):

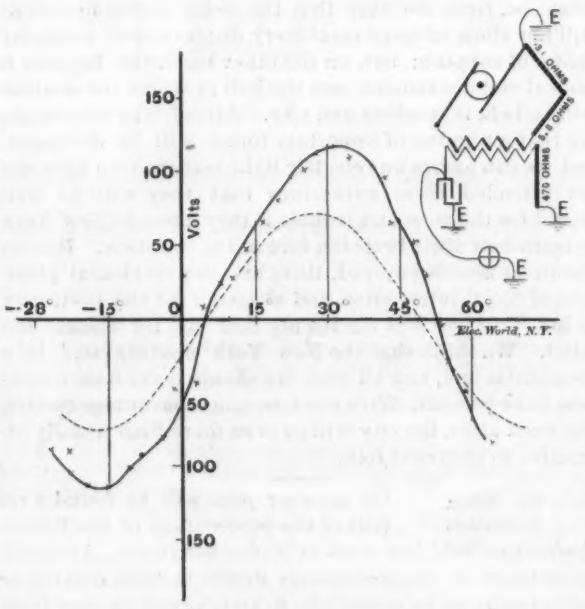


FIG. 3.—EXPERIMENTS ON INDUCTION COILS.

$$r'=R+\left(\frac{2\pi}{T}\right)^2\frac{M^2\,R'}{R'^2+\left(\frac{2\pi}{T}\right)^2L'^2}; \qquad (21)$$

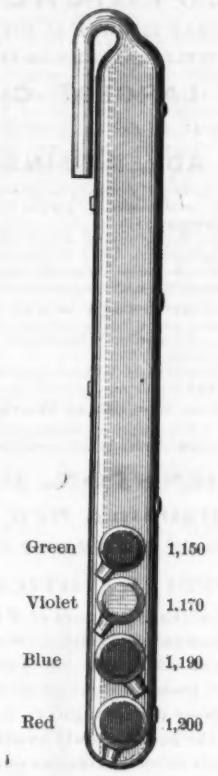
$$A'^2=\left(\frac{2\pi}{T}\right)^2\frac{A^2\,M^2}{R'^2+\left(\frac{2\pi}{T}\right)^2L'^2}. \qquad (22)$$

If we compare these values with those given above—(13) and (17)—(and this is true in every case), we will see that they differ by the substitution for L' without the condenser, of $\left\{L'-\left(\frac{T}{2\pi}\right)^2\frac{1}{C}\right\}$ with the condenser. The effect of introducing the condenser then is simply to *decrease* the apparent self-induction of the secondary by a quantity varying *inversely* as the capacity and *directly* as the square of the period.

The induction coil used had a short, thick cylindrical core of iron wire. Its constants have been given. Fig. 1 represents the current in the primary; Fig. 2 the current in the secondary; Fig. 3 the difference of potential between the coatings of the condenser. With the observed curve in the first case is drawn a sine curve corresponding with it in phase and amplitude; in the two last cases the dotted lines represent calculated sine curves, the full lines the observed curve.

The Hicks Glass-Bead Hydrometer.

The accompanying figure taken from the London *Electrician* shows a new pattern hydrometer which has recently been brought out by Mr. J. Hicks, and which will be found to be well adapted for the rapid testing of accumulator cells. Only a few words of description are needed. The hydrometer as seen in the figure consists of a glass tube pierced at the bottom and on the sides by several holes to admit the free access of the liquid. Within the tube are four small specific gravity bulbs of different colors, placed one above the other, and capable of freely rising and falling in the tube, which they nearly fit. The top bulb, which is colored green, will float when the specific gravity reaches 1.150, the violet at 1.170, the blue at 1.190, and the red at 1.200. These figures are clearly marked on the back of the tube. Any ordinary workman can be intrusted with the use of this instrument where the reading of a scale might lead to errors.



A NEW GLASS BEAD HYDROMETER FOR ACCUMULATORS.

Storage Car Regulating Switches.

To the Editor of The Electrical World:

SIR: On page 53 of your Aug. 4 issue I find a communication from Mr. H. F. Parshall, in which your editorial judgment is impeached for having used the term "Julien Regulating Switch" in describing the invention of M. Edmond Julien.

The ground on which the argument is based is, to quote *literatim et verbatim*, "that a similar switch has been used by the Sprague Electric Railway and Motor Company in experimental working, Mr. Sprague having designed such a switch some years ago." Without wishing to open a controversy, I beg to observe that the patent of M. Julien does not necessarily cover the name, and that if Mr. Parshall has any *similar* devices he is entirely at liberty to suit his preferences as to the name he would like them known by, provided they do not embody the *identical devices and combinations* covered by M. Julien's patent.

I cannot now remember how many years ago the "Julien Regulating Switch" was designed by M. Julien, nor how long it was used in *experimental working* before being submitted to the public, but I think it sufficient to state that it was used *practically* by M. Julien early in 1885, and notably at the Antwerp Exposition, on a car in regular operation, a period which is over two years anterior to the time when the Sprague Electric Railway and Motor Company first thought of experimenting with storage batteries on street cars.

It may not be out of place to state, in conclusion, that the Julien regulators to be used on the new cars of the Fourth and Madison avenue line differ slightly from the form described in your issue of July 21.

C. O. MAILLOUX,
Electrical Engineer, The Julien Electric Traction Co.

Electric Lighting on a Yacht.

The accompanying engraving, for which we are indebted to our esteemed contemporary *Industries*, represents a combined engine and dynamo manufactured by

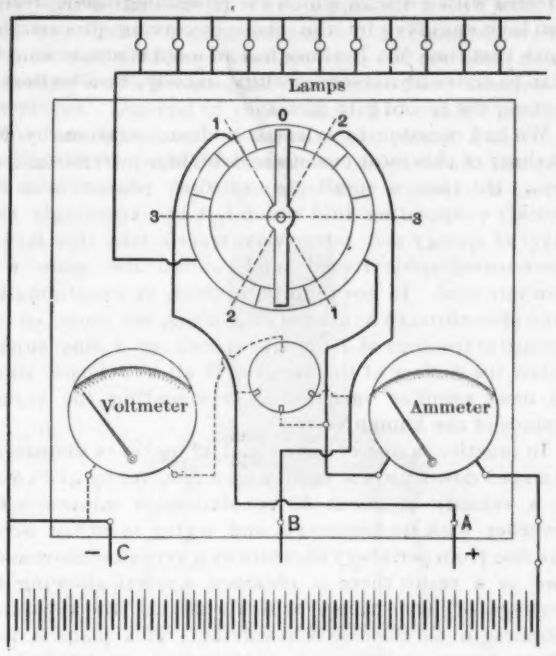


FIG. 2.—DIAGRAM OF SWITCH CONNECTIONS.

Messrs. W. H. Allen & Co., of York Street Works, Lambeth, London, for the new steam yacht "Lady Torfrida," built by the Fairfield Shipbuilding and Engineering Company, of Govan, for Sir William Pearce. The vessel is 216 ft. long and 26 ft. beam, and is fitted with triple expansion engines, indicating 1,400 h. p., her speed being about 16 knots. The electric lighting of pleasure yachts differs somewhat from that of ordinary passenger steamers, inasmuch as there is a greater variation in the number of lights employed at different times. In a large passenger steamer the number of lights burning simultaneously is, as a rule, at all times sufficiently large to make it worth while to work the dynamo; but on a pleasure yacht it may often happen that during a considerable time only a few lights are required, and it is therefore desirable to use storage batteries. The "Lady Torfrida" has consequently been fitted with a battery of storage cells, so that the light may be available at all times whether the steam dynamo is at work or not. The capacity of this battery, which consists of twenty-six E. P. S. cells of the 15 L. size, is sufficient for one evening's supply of light, so that the dynamo need never be worked on a Sunday, the practice being to charge up on the Saturday, and draw on the batteries for the supply of current until the following Monday. The cells are specially designed for use on ship board. They are completely closed, so that the acid may not be spilled when the vessel rolls, and they are arranged in two trays above each other, and suspended from the deck above by iron supports. The trays are so arranged that should any acid be spilled it will be caught before it can reach the bottom of the vessel, where it might do damage to the steel work by corrosion.

Where an electric light installation contains storage batteries it is generally considered necessary to place it in the hands of a competent electrician, whose duty it is to look after the cells and regulate the number in use at any time, so as to maintain the lights at equal brilliancy whatever may be the number of lamps burning simultaneously. As, however, in a small installation it would not pay to employ a man specially to look after the electric plant, this has been designed with the view of making special supervision unnecessary. The number of cells during charging and discharging remains the same, but by means of a special switch, to be presently described, the constancy of pressure is maintained in the mains whether the light be supplied direct from the dynamo or from the batteries. The average pressure required for charging is about 2.5 volts per cell, whereas the available pressure on discharge is only about 2 volts, and consequently the 26 cells can only supply current at a pressure of about 52 volts.

The lamps installed require 50 volts E. M. F. to bring them up to full incandescence, and a margin of 2 volts has been allowed for resistance in the leads. The dynamo, when lighting direct, must therefore supply current at 50 to 52 volts pressure, whilst when charging the battery it must give a pressure rising to 65 volts at the end of the charge. This rise of pressure could be obtained by increasing the speed of the engine; but as this would require re-adjustment of the governor each time the work of the dynamo was shifted from the lamps to the cells, it was thought preferable to obtain the rise of pressure by an increase in the strength of the field, and this has been attained by splitting up the shunt winding on the field magnets into two coils which can be placed either in series or parallel, the former connection being used when the dynamo works compound and supplies current direct to the lamps, the latter when the dynamo works as a plain shunt machine and charges the battery.

The change from series to parallel is effected instantly by a compound switch shown in the engraving on the top of the field magnets. The connection between the switch and the exciting coils will be understood from the annexed sketch, Fig. 2A. *M* represents the main field magnet coil, and S^1 S^2 represent the two halves of the shunt coil. When working compound, the switch is placed in the position shown in the sketch—that is, with the contact levers inclined. When working as a plain shunt machine, the insulated bar on the top of the switch levers is pulled to the left, bringing the levers vertical, and in that condition the connection between the end of the main coil *M*

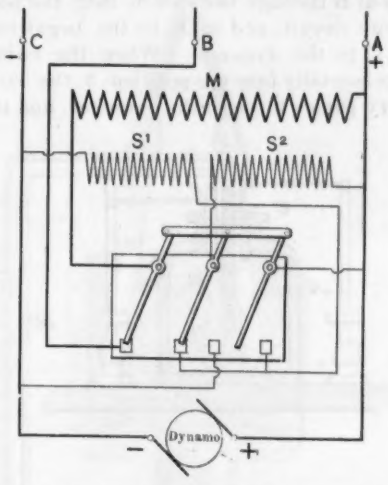


FIG. 2A.—DIAGRAM OF SWITCH CONNECTIONS.

and terminal *B* is broken by a third switch lever. The object of this will be explained presently.

When working compound, the current starting from the positive brush passes through the main coil, and out by terminal *B*, to the switch-board Fig. 2, corresponding terminals being similarly lettered. The shunt current passes into coil S_2 down the middle lever, then into coil S_1, and back to the negative brush on the commutator. The connections of batteries, dynamo, and lamps are shown in the sketch, Fig. 2. By means of the switch at the top the dynamo may be coupled either direct to the lamps when the batteries are cut out, or it may be coupled direct to the batteries when the lamps are cut out, or the lamps may be coupled direct to the battery when the dynamo is cut out. It is thus impossible to charge the batteries and light the lamps direct from the dynamo at the same time, and by this means is prevented the possibility of over-straining the lamps, which would be the case were it possible to charge and light simul-

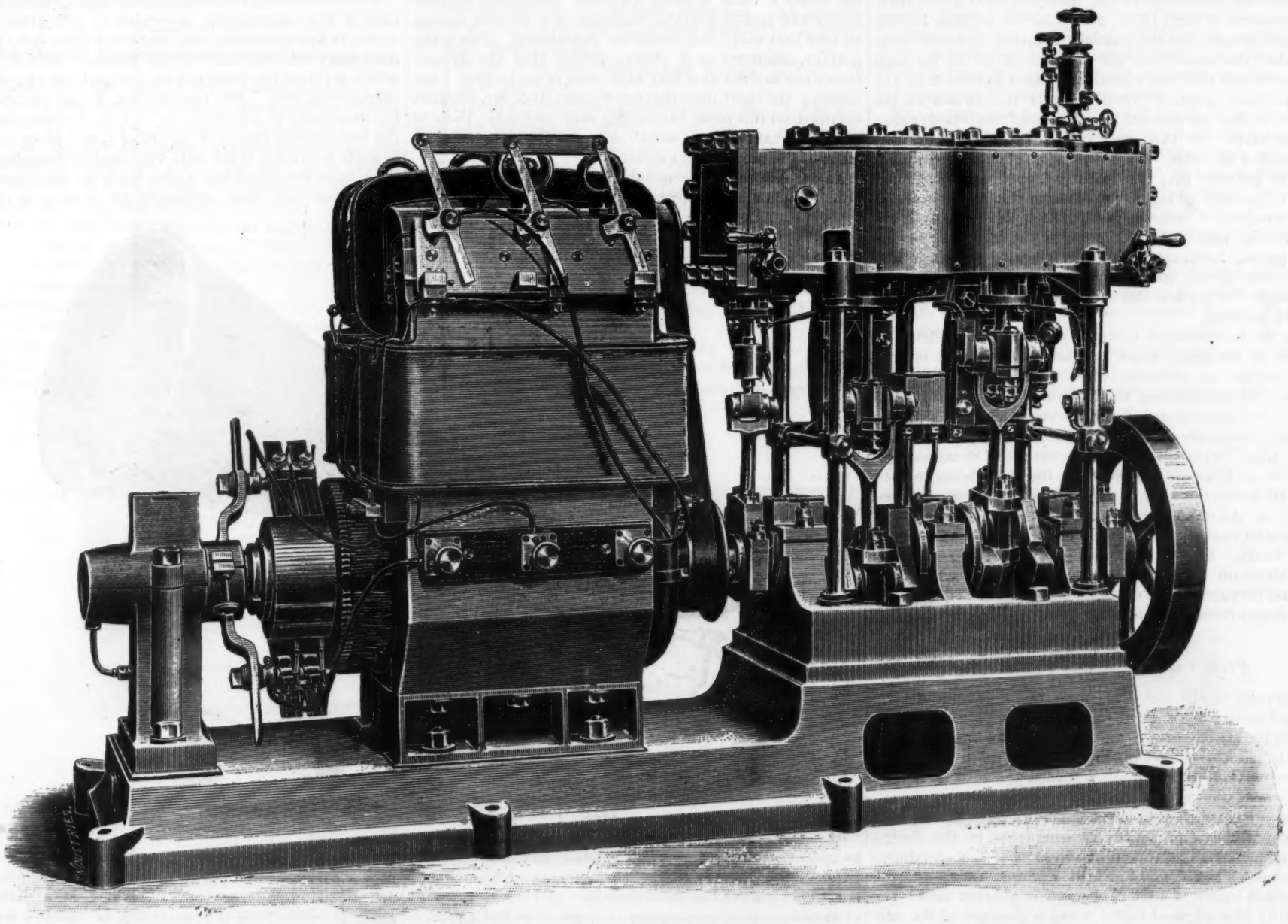
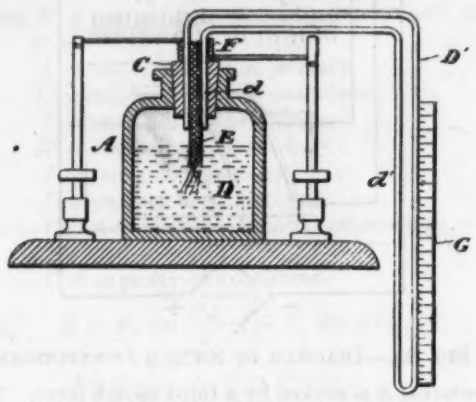


FIG. 1.—A COMPACT PLANT FOR YACHT LIGHTING ON THE "LADY TORFRIDA."

taneously, since the pressure required to charge the battery is higher than that for which the lamps are intended.

When the switch lever is in the position 0, shown in the diagram, Fig. 2, both lamps and battery are cut off from the dynamo. If the lever be put into position 1, the current from the dynamo entering by terminal *A* flows through the ammeter into the battery through the fuse *F*, and returns by terminals *C* to the dynamo. The fuse is a thin copper wire, not fastened by screws, but soldered to the mains to insure good contact. When the switch lever is placed in position 2, the current from the dynamo passes by terminal *B* through the switch into the positive main of the lamp circuit, and back by the negative main and terminal *C* to the dynamo. When the switch lever is placed horizontally into the position 3 the current from the battery passes through the ammeter, and through the



FORBES' NEW COULOMB METER.

switch to the positive main of the lamp circuit, and back direct to the negative terminal of the battery.

It will thus be seen that by manipulating the switch on the dynamo and that on the main switch board, the attendant can either charge the batteries, light direct from the dynamo, or light from the batteries, without having to alter the speed of the engine. It might, however, happen that the switch on the dynamo is set for the high pressure, and that the attendant forgets to alter it to the low pressure position when he puts the switch on the board, so that the current passes direct from the dynamo to the lamps. In this case, as the dynamo produces a pressure of 65 volts, the lamps would be over-strained, and to prevent this the third switch lever, mentioned above, has been added on the dynamo. It will be noticed that when the switches controlling the shunt current are set vertical, the third lever, through which the main current passes, interrupts the main circuit, and thus it is impossible for the attendant to get any light at all if he has neglected to place this switch to the position for compound working.

On the switchboard is fitted a voltmeter, which, by means of the small triple contact switch *s*, can be connected with the different wires, so that one voltmeter suffices for ascertaining the pressure in the various circuits. The connections of the voltmeter switch *s* with the various circuits are shown by dotted lines. The dynamo is of the "Kapp" type, designed for an output of 80 ampères at 52 volts, or 40 ampères at 65 volts, the speed being in both case 310 revolutions per minute. The armature is coupled direct to the crank shaft of an "Allen" double acting compound engine, with 4¼-inch and 8 inch cylinders by 4-inch stroke. The working parts have been designed for the full steam pressure of 160 lbs. carried in the main boilers, though 100 lbs. of steam is sufficient to obtain the full output from the dynamo.

Prof. Forbes' Latest Electric Meter.

Our readers will recall to mind the ingenious electric meter* invented by Prof. George Forbes, of London, in which the air currents rising from a conductor heated by the electric current are made to drive a light mill-wheel, the revolutions of which are recorded and thus serve as a measure of the current passed through the meter.

Recently Prof. Forbes has applied the same principle of utilizing the heat produced in a conductor in the design of a new meter. In this instrument the heat produced evaporates a liquid contained in a closed vessel and the vaporized liquid is then condensed in another vessel, the quantity of condensed liquid being a measure of the current passed through the meter.

The accompanying engraving shows the meter diagrammatically. As will be seen it consists of a glass tube *D'* bent twice at right angles to form a short leg *d*, which passes through the stop *C* and opens into the vessel *A*, and a longer leg *d'*, which passes outside the vessel *A*, and is closed at its lower end. A wick *E* of absorbent material, such as cotton, dips into the liquid in the vessel *A* and projects up into the leg *d* of the tube. A coil of wire *F* is wrapped around the outside of leg *d*, and the current to be measured passes through this coil, which is made of higher resistance than the rest of the circuit, so as to be more readily heated by the current. A scale *G* allows the amount of liquid in leg *d'* to be readily gauged.

The operation of the meter will now be readily understood. The liquid in the vessel *A* is absorbed by wick *E*, and the heat from the coil *F* produces an evaporation of the liquid in the wick. The vapors created pass over into the leg *d'* of tube, are therein condensed, and the amount of liquid collected in the tubes serves as a measure of the quantity of electricity which has passed through the coil.

The instrument is said to be accurate, and to read proportionally over wide ranges of current.

* See THE ELECTRICAL WORLD Aug. 6 and Oct. 22, 1887.

The Improved Gramophone.

In November of last year we published the researches of Mr. Emile Berliner, of Washington, in apparatus for the recording and reproducing of articulate speech and other sounds. Since that time Mr. Berliner has been occupied in further developing the invention, and has brought to bear on the subject new ideas which not only have simplified the manipulation of the process, but also wonderfully improved its efficiency. We had opportunity last week to witness a private performance of the improved machine in thi city by Mr. Berliner, and the results which he obtains with the new apparatus are indeed marked to an extent which makes it certain that the aim of the inventor to reproduce the human voice in its natural loudness and with an absolute recognition, is very nearly accomplished. We have heard songs every word of which could be plainly understood, and so loud that going out of the room and into the hall, 50 feet from the instrument, we could still plainly hear the same. A song by a child 12 years old, was reproduced with such marked characteristics that any body without knowing who sang it could not but have made out from the way it was rendered that it was a child's voice. There were also songs with organ accompaniment, cornet solos, duets, plantation songs by a negro, all of which exhibited the peculiar characteristics in each case. We are assured by Mr. Berliner that the recognition of the voice by persons knowing the performer is absolute. He has cited to us a case where a child seven years old has recognized his father's voice without knowing beforehand that his father had spoken into the machine, and without having an idea that that voice would be reproduced. This is important, inasmuch as it clearly proves that the gramophone has arrived at a very high state of perfection. Considering the short time that has elapsed since Mr. Berliner commenced this most interesting original study, there is no doubt that the next month or two will see the achievement of the most perfect results.

As our readers may remember, the gramophone is based not so much upon the principle of the modern phonograph as upon that of the Leon Scott phonautograph which was patented in France in 1887. The phonautographic record consists of a wave line upon a surface, and is not a record of an indentation into a material or the record of a process of cutting or graving out. It was reserved to a Frenchman, namely, Charles Cros, to first conceive the idea of utilizing the Scott phonautograph, or Scott phonautographic record, for the reproduction of speech. In a paper read by Mr. Berliner on May 16, 1888, before the Franklin Institute in Philadelphia, he published the full account of Mr. Cros' ingenious conception.

According to Mr. Berliner's statement, which can be verified by referring to Vol. 85 of the *Comptes Rendus* of 1877, page 1,082, Mr. Cros, in April of that year, laid down the correct principles underlying the gramophone, namely, to engrave the Scott phonautographic record into solid material and to use this engraving for reproducing the sound which made the record. It does not detract from Mr. Berliner's credit that he independently and without previous knowledge of Mr. Cros' prior conception resurrected this idea ten years later, and at a time when Mr. Cros had not only long since abandoned experiments in this line but even when Mr. Cros' paper was almost unknown to the scientific world.

The first performance by the gramophone last year was effected with a disc in which the phonautographic record had been engraved by the photo-engraving process, but since that time Mr. Berliner has adopted a much simpler plan to arrive at the same results, namely, by a method of etching the record into metal.

We had occasion to witness a demonstration by Mr. Berliner of this most curious and highly interesting process. He took a small disc of zinc, poured upon it a quickly evaporating fluid which left an exceedingly thin layer of spongy and fatty wax, traced into this layer a phonoautographic record and etched the same with chromic acid. In less than 15 minutes, on examining the zinc plate through a magnifying glass, we observed the beautiful tracings of articulate speech as a line sunken below the surface of the metal with all its delicate waves in most peculiar varieties as representing the various sounds of the human voice.

In practice, a disc of zinc about 12 inches in diameter is clamped down upon a table which revolves by clockwork at a velocity of about 50 revolutions a minute. The recorder with its diaphragm and stylus is moved across the disc from periphery to centre by a very slow movement, and as a result there is obtained a spiral, showing the tracings of the voice, which affects the recording diaphragm as the disc is revolving. This plate is then plunged into a solution of chromic acid and left in there for about 15 minutes when it is taken out, washed off, and cleaned. It is then ready for reproduction. When found satisfactory it may be multiplied either by the electro-plating process, or by inversing the record upon celluloid, plaster of Paris, sealing wax, type metal, or any other substance capable of being molded with ease. The copies thus obtained from the original plate reproduce the voice with the same fidelity as the original record.

Notwithstanding the simplicity of the etching process that of the reproducing apparatus is still greater. As shown in the accompanying engraving there is no gear or machinery of any kind except a small friction wheel which revolves the table having clamped down upon it the reproducing disc. The reproducing stylus connected to the diaphragm is permitted to rest by its own gravity in the reproducing groove of the record, and when the plate is made to revolve it not only vibrates the diaphragm and reproduces the sound but it also leads the diaphragm box across the disc from periphery to centre so that the record groove serves at the same time as a screw instead of a separate gear. The recording diaphragm and stylus are attached to a lever which is pivoted at a distance of about 18 inches from the centre line of the disc, and as it slowly swings across the disc it describes an arc of very flat amplitude. It may be objected that the motion given by the hand to the disc would not be sufficiently regular; but while it is true that it would be desirable to have a motor attached to the machine, there is no difficulty whatever in revolving the disc regularly by hand, and by hanging up a small pendulum to swing before the eyes of the manipulator he can regulate the revolving motion by the swinging of the pendulum.

Every disc or "phonautogram," as Mr. Berliner calls it, has engraved at its centre the name of the piece which it reproduces, and also the number, 40, 50 or 60. This indicates that the recorder moved at a velocity of 50 revolutions a minute, so that wherever a disc may be used for reproduction people will know at what velocity to revolve the disc in order to obtain an accurate reproduction of pitch and quality.

THE IMPROVED BERLINER GRAMOPHONE.

A Simple Arc Lamp

M. Pollak has recently constructed an arc lamp the regulation of which is effected by means of the expansion and contraction due to wires placed in circuit with the carbons. The accompanying engraving, Fig. 1 shows the first form of this lamp constructed. *a a'* are brass wires, from 4 to 5 mm. in diameter, intended to carry a current of 5 ampères. One end of each wire is fixed to two spirals, which are continued in the straight pieces *d d*, which again take the spiral form, acting as carbon-holders for the carbons *e e'*. The expansion and contraction of the

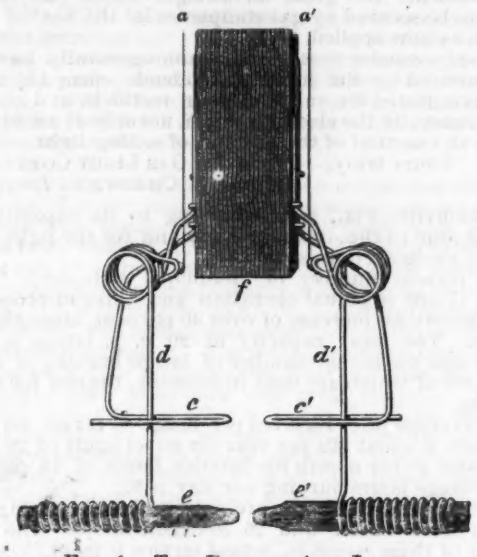


FIG. 1.—THE POLLAK ARC LAMP.

wires *a a'*, acting at the end of a lever, as shown, increases or decreases the length of the arc. In Fig. 2 the wires *a a'* similarly act at the ends of levers and against the action of springs, as shown.

The New Howell Voltmeter with Clark Standard Cell.

The Latimer Clark cell is, with right, generally accepted as the best and most reliable standard, and is used in the best laboratories in this country and Europe as the standard of electromotive force. Lord Rayleigh has given much attention to this cell, and he has kept cells during seven years, which have, during that time, maintained a constant E. M. F. and are still perfectly good. When not in use the cell is absolutely inactive and suffers no deterioration; so that, if not used, it would last an indefinite time if it were so perfectly sealed that no evaporation of the liquid took place.

Recognizing this superiority of the Clark cell, Mr. John W. Howell has arranged a voltmeter, shown in the accompanying engravings, in which a Clark cell is employed as a standard. This voltmeter which is made by the Edison Lamp Company, is a potentiometer by which the electromotive force of any circuit may be measured by direct reference to a pair of Latimer Clark cells. The instrument is very simple and requires no skill to enable any one to measure electromotive forces or pressures, quickly and accurately.

Clark standard cells as made in Europe and sold both there and in this country, are unfit for use in portable potentiometers or voltmeters, and for two reasons: First, they are not portable, and second, they can not be used to give even small currents without seriously affecting the E. M. F. of the cells. Such cells would be entirely worthless for use in a portable voltmeter, for if the same were turned upside down the cell would be ruined and the current necessarily furnished by the cell in making measurements would very soon spoil the cell.

The cells used in the voltmeter illustrated have neither of these defects. They are portable and can be used to furnish all the current necessary. To test their portability Mr. Howell carried one of them loose in his pocket for seven months, and during this time it remained perfectly constant, and always agreed with the standard cells.

Portable voltmeters, including these cells, have been in use for eight months, and although used daily have always given correct results. To determine how long a cell would last when giving current, an engine room indicator was made on this principle, using one of these cells. It has been in circuit eleven hours a day for ten weeks, the battery giving or receiving current with every variation in the pressure on the line. During this time the indicator has always indicated correctly, well within the limits of practical work, and the cell is to-day apparently as good in all respects as it was when new.

Each voltmeter is provided with two cells which are entirely independent, and afford two separate standards to be used in making a measurement. As long as these two cells agree and both give the same value for any pressure to be measured there is a reasonable assurance of the accuracy of the work. When the plug is in either hole marked 1, Fig. 2, one of the cells is in use. Any pressure may be measured with the plug first in one of these holes, and then in the other, and the two readings will agree, thus verifying the results.

When the plug is in the hole marked 2 the two cells are in series. This enables one to measure pressures twice as high as the scale indicates, and their value is known by doubling the scale reading.

The Clark cells, as is known, vary slightly with temperature. The voltmeters are standardized to be right at 75 degrees F. and for all ordinary work no temperature correction is necessary, as it takes 24 degrees to make an error of one per cent. To allow for temperature, however, a thermometer is placed in each voltmeter, which gives the correction necessary for accurate work without any calculation. The thermometer is graduated in quarters of a volt. Below the 75-degree mark the word "add" is marked; above 75 degrees is the mark "subtract," so that by observing the position of the mercury we can "add" or "subtract" from the reading ¼, ½, ¾ or 1 volt, as indicated. There are no degree marks on the thermometer, only a mark is placed at every six degrees, so that the temperature correction is made instantly and without any possibility of a mistake.

These instruments are of high resistance, and can be left in circuit for any length of time without in any way affecting their accuracy.

The E. M. F. of these cells is well known, and is 1.43 volts at 70 degrees F.

The accuracy of the scale readings may be tested at any time by a Wheatstone bridge in the following manner: Measure the resistance of the voltmeter between the spring line-connections, and call it *y*; then measure the resistance from one of these terminals (the one giving a low resistance) to the sliding contact piece, and call this *x*: then the scale reading for this position of the sliding contact is equal to $\frac{1.43\,y}{x}$. Any one can thus test the value of any scale reading, and as long as the two batteries read the same the accuracy of the readings can be depended upon.

The attachment cord by which the voltmeter can be connected to any lamp-socket is shown in the engraving, Fig. 1. When the voltmeter is attached to any lamp-socket, the lamp is necessarily taken out and the tester is frequently left in darkness. In order to have light when using the voltmeter, the attachment plug is so made that the lamp can be screwed into it and give light, and also give any drop in the wires which exists when the lamp is in use. This enables one to measure the pressure at any lamp under exactly normal conditions with the lamp burning; evidently, a valuable feature. Our engraving, Fig. 1, shows the instrument inclosed in its case, so as to be easily carried from place to place.

The other details of construction and arrangement of the instrument are similar to those of the Howell voltmeter described in our issue of December 31, 1887.

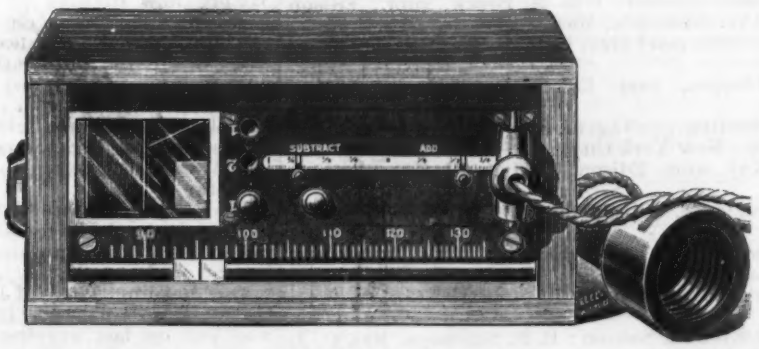


FIG. 1 AND 2.—THE NEW HOWELL VOLTMETER WITH CLARK STANDARD CELL.

Elongating the Core of the Gramme Armature.

To the Editor of The Electrical World:

SIR: In your issue of July 21 Mr. R. M. Hunter attempts a criticism of a statement made by me to the effect that "no investigations are on record as to the dividing line between advantage and disadvantage as the result of elongating the core of a Gramme armature." If Mr. Hunter understands what the statement means—which I very much doubt—he will concede the truth of it. In order that he may fully understand what is meant, I will amplify the statement, and say "No investigations are on record which demonstrate how far the core of a Gramme armature may be lengthened to advantage, or which give the most economical ratio between the length and radial thickness of the core."

I have not "overlooked Mr. Hering's new work," but have read and studied every page of that admirable book, and I fail to find a line in the whole of it which definitely points out the best proportion for the core of a Gramme

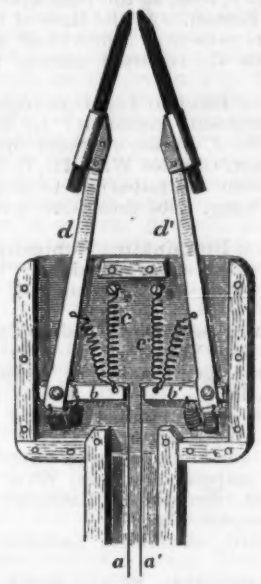


FIG. 2.—THE POLLAK ARC LAMP.

armature. Mr. Hering says plainly: "In regard to the shape of the cross-section of the ordinary Gramme armature core no general rules can be given, as it will depend greatly on the general construction of the machine. * * * In general, the cross-section will depend on the general style of the machine, and, therefore, *the best shape should be found by choosing from calculations made for several assumed shapes.*" The italics are mine.

Mr. Hunter refers us to pages 104 to 115, of Mr. Hering's work, for information relative to the most advantageous shape for a Gramme armature core; these pages are given up almost entirely to the subject of armature winding, output, etc., the only mention of the core being directions for calculating its *circumference*. Will Mr. Hunter please say what this has to do with the shape of the cross-section of a core?

Again, pages 231 to 240 are held up to expose the falsity of my inoffensive statement. These pages embrace an appendix which treats of "the so-called 'dead wire' on Gramme armatures," and does not once mention the shape of the core! Where is there here information regarding the subject under discussion?

I still maintain that "no investigations are on record as to the dividing line between advantage and disadvantage as the result of elongating the core of a Gramme armature."

CECIL P. POOLE.

LYNCHBURG, Va.

The Winding of the Baxter Dynamo.

To the Editor of The Electrical World:

SIR: In the description of the large generator built by the Baxter Electric Mfg. & Motor Company, it is stated that the potential is 2,500 volts and the current 40 ampères. The resistance of the armature was given as 64 ohms and that of the field magnets at 70 ohms; that is, $R_a + R_m = 134$. Now by Ohm's law the external resistance (R_e) is $\frac{2500}{40} = 62.5$ ohms, and if the other figures are correct the work performed in the machine would be more than double that in R, since 40 ampères would be driven through 134 ohms in the first case and only 62.5 ohms in the latter.

I am sure that error has crept in somewhere, as even if 64 and 70 were misprints for 6.4 and 7.0, the efficiency could not be greater than 70 per cent. I do not thus criticise without an object. We all want to know

something about any new machines, and if constructors give very meagre descriptions of their machines they should at least be correct to be of any value.

AKRON, O. ROBERT S. DOBBIE.

Eighth Meeting of the Association of Edison Illuminating Companies.

The eighth semi-annual convention of the Association of Edison Illuminating Companies was called to order by the president, Mr. John I. Beggs, at 11:30 A. M., Wednesday, Aug. 8, 1888, at the Nantasket Hotel, Nantasket Beach, near Boston. At the time of convening there were 36 members present. Additional members, bringing the total up to 57, reported during the sessions, as follows:

From the Edison Electric Light Company, New York City: E. H. Johnson, president; J. H. Vail, general superintendent; W. J. Jenks, manager Municipal Department; L. Stieringer, Charles Wirt, H. T. Edgar.

From the Edison Illuminating Company, New York City: John I. Beggs, vice-president and general manager.

From the Edison Illuminating Company, Boston, Mass.: C. L. Edgar, general superintendent; Hubbard Breed, treasurer; W. A. Hill, W. H. Atkins, E. L. Caldwell, H. H. Niles.

C. J. Field, chief engineer Edison United Manufacturing Company, New York City.

Chr. Wustenfeld, gen'l manager Edison Illuminating Company, Elgin, Ill.

A. M. Renshaw, gen'l manager Edison Electric Illuminating Company, Washington, D. C.

R. M. Jones, gen'l manager Laramie Electric, Gas Light and Fuel Company, Laramie, Wyo. Ter.

Magnus Pflaum, director McKeesport Electric Light Company, McKeesport, Pa.

H. Ward Leonard, electrician Leonard & Izard, Chicago, Ill.

A. L. Smith, president Edison Electric Illuminating Company, Appleton, Wis.

F. C. Kurz, superintendent.

C. P. Gilbert, gen. manager, John R. Markle, director, Edison Electric Illuminating Company, Detroit, Mich.

J. W. Schroeder, Edison Company, Roselle, N. J.

Wilson S. Howell, treasurer Association of Edison Illuminating Companies.

Albert F. Dow, president; J. H. R. Ward, electrician, Edison Electric Illuminating Company, Fall River, Mass.

Thomas P. Merritt, president; F. N. Boyer, secretary, Edison Electric Illuminating Company, Reading, Pa.

C. R. Price, treasurer Edison Electric Illuminating Company, New Bedford, Mass.

F. R. Upton, treasurer; F. E. Jackson, assistant electrician; B. F. Card, agent, Edison Lamp Company, Harrison, N. J.

Geo. H. Kirchwey, president; H. L. Browning, director, Edison Elec. Ill. Co., Albany, N. Y.

E. H. Brooks, manager Edison Elec. Ill. Co., Lebanon, Pa.

W. J. Paine, manager N. E. Wiring and Construction Co.

E. B. Greene, supt. Edison Electric Ill. Co., Altoona, Pa.

William C. Turner, secretary and general manager; F. B. Drake, treasurer, Edison Electric Illuminating Company, Columbus, O.

Samuel N. Trump, president; J. A. Lighthipe, electrician; F. L. Gilpin, secretary, Wilmington City Electric Company, Wilmington, Del.

S. B. Paine, agent Edison Co., Boston, Mass.

W. H. Francis.

A. O. Shepardson, general manager Connecticut Electric Company, Waterbury, Conn.

W. L. Garrison, treasurer; Geo. W. Palmer, Jr., supt., Edison Electric Ill. Co., Brockton, Mass.

G. W. Russell, director; Wm. M. Brock, supt., Edison Electric Ill. Co., Lawrence, Mass.

J. B. C. Roberts, gen'l mgr. Edison Elec. Ill. Co., Cumberland, Md.

Maurice Hoopes, supt. Edison Elec. Ill. Co., West Chester, Pa.

H. McL. Harding, gen'l agent, Sprague Electric Railway and Motor Co., New York City.

H. K. McKay, supt. Edison Electric Ill. Co., Birmingham, Ala.

J. E. Giles, supt. Edison Electric Ill. Co., Hazleton, Penn.

H. L. Brewster, sec. Edison Electric Ill. Co., Rochester, N. Y.

J. S. O'Brien, supt. Edison Electric Ill. Co., Wilkesbarre, Pa.

Invited at Evening Session: B. F. Simmons, Mrs. C. J. Field, Mrs. A. L. Smith, Captain Brophy, W. I. Barker, and T. C. Martin, THE ELECTRICAL WORLD; R. F. Ross, *Modern Light and Heat;* Mr. Boynton, treasurer New England Telephone Company.

After the president had made a brief address, congratulating the association on the large number of representatives present from points covering such a wide extent of country, the minutes of the last meeting, held at Chicago, were approved, as printed and sent out by the secretary. Mr. Turner, manager of the Columbus, O., company, presented before the association some very interesting load diagrams, showing comparisons of load variations during holidays and on account of sudden thunderstorms, etc., the details of which were fully discussed.

The subject of electric motive power, and its widely increasing application, as employed in different branches of manufacture, was very ably presented by Mr. Harding, whose statements were fully verified by the testimony of numerous members.

During the afternoon session, the association's new officers and executive committee for the ensuing year were elected as follows: President, John I. Beggs; vice-president, C. P. Gilbert; secretary, J. H. Vail; treasurer, Wilson S. Howell; executive committee, A. L. Smith, F. R. Upton, C. L. Edgar, T. P. Merritt and R. M. Jones.

At the evening session, Mr. W. J. Jenks read before the association and visitors, to whom a courteous invitation had been extended, a very able and exhaustive paper on the subject of lightning and its effects on electric light, telephone and telegraph systems. This paper was splendidly illustrated by numerous stereopticon views. At the close of the paper, Mr. Harding exhibited a series of stereopticon slides showing the principal features of the Sprague system of electric railways as well as some novel applications of electric motive power in rolling mills, flouring mills, printing offices, and for other industrial purposes.

The convention then adjourned until 9:30 A. M. on Thursday.

At the opening of the convention on Thursday, Mr. Jackson presented an excellent and thorough paper on the new high economy Edison lamp, and its application and use in Edison stations during the past year. This paper went to show that the lamp had proved to be all that Mr. Edison had guaranteed to the companies, and that it was giving high economy, long life and very satisfactory results in every particular. Following this came an address by Mr. Upton on some pertinent points of a similar nature.

Mr. Charles Wirt read a very able paper on the subject of "feeder equalizers" and the regulation of electrical pressures in three-wire systems of distribution. This was followed by another not less admirable paper by H. Ward Leonard, on the subject of proportioning the conductors in systems of electric lighting so as to obtain the most perfect equalization of pressures and to cover large areas with the minimum amount of copper. Both of these papers were very accurate and to the point, and showed a comprehensive grasp of the difficult questions of electrical distribution. The various merits of the different systems presented were fully discussed by the association.

An address was delivered by Mr. Johnson on the standing of the Edison patents, and there was also a very interesting discussion on statements, by Messrs. Leonard and Field, on the comparative cost of installation of the Edison three-wire system and the alternating current converter systems. The discussion included the question of the distances effectively covered by each system. In numerous instances cited it was considered proven beyond all doubt that the Edison three-wire system gave better distribution and covered fully as great distances, yet at a less cost than the alternating system.

A highly interesting report was made by Mr. Jenks on the growing use of the Edison municipal system, in which he stated that the following plants were now in operation, giving the best of satisfaction:

His report was practically as follows:

The growth of the municipal business since the last session has been healthy and gratifying. Stations have been started in Laramie, Wyo.; Somerville, Mass., and Reading, Pa., and installations are now being made in Chester, Pa.; Chatham, N. B., and Sioux City, Iowa, with a capacity of 2,150 20-c. p. lamps.

Laramie started up Feb. 26 with four circuits and 178 20-c. p. lamps. The manager, Mr. R. M. Jones, under date of Feb. 29, wrote us as follows:

"We have had two circuits of the municipal system in successful operation for the past three nights. In fact, there has been nothing but success connected with that system with us, as it moved off properly in every respect, the same the first time we speeded up as at any time since. It is far better light for streets than the domestic lamps, owing to the whiteness in color."

Under date of May 11, Mr. Jones writes as follows:

We have run three circuits for several months, ever since I notified you of our starting. We started without a bad hitch in any respect and have continued every night since without the slightest trouble, until last night when we had a fearful storm and one of the circuits was broken and left out all night; the cause was a broken wire. "It is less trouble than the domestic system, and gives perfect satisfaction. We have 960 c. p. in each circuit. The machine and all apparatus works without trouble."

At Somerville, Mass., a plant was started up about May 1, and the following extract from a letter of the manager, dated July 23, shows the flexibility of the system:

"In regard to information concerning municipal system, would say that I have nothing of importance to report, as, since my letter, we have had no incidents nor accidents to interfere with our municipal work. We are now running 70 lamps on each circuit (about 2 miles wire to the circuit), chiefly 25's and 30's and the public are well satisfied with the light. In the few cases where the automatic resistance-box has been required, it has never failed to work, fully protecting the lights on the other circuits. We are now running on the complete circuit 7 arc lights, and 8 50's and 34 25's of the Bernstein series incandescents, together with 210 municipals, the current being supplied by an American 50-light machine."

The Reading Electric Light and Power Company received a contract in June for the city lighting, arc and incandescent, and have introduced 500 20-c.p. lamps, displacing the gas lamps.

The Reading *Times* of July 30 contains the following commendatory notice: "The third circuit of electric lights was put on last evening for the first time, and all the smaller streets from Walnut street north to Windsor were brilliantly lighted by electricity. General manager Boyer and superintendent Arrowsmith last night made a thorough inspection of the new circuit and found every lamp burning, and words of praise for the excellence of the light on every hand."

At Chester, Pa., a plant consisting of a 600-light dynamo with about 200 lamps as a first instalment, is nearly completed which will supersede the gas now used.

Chatham, N. B., and Sioux City, Iowa, will also be supplied shortly with our municipal system.

Several of the stations have materially increased their business in the last six months, notably Denver, Col., where the number of lamps has been increased 50 per cent., or from 600 to 900, and the company have secured a very favorable contract for three years more.

Lockport, N. Y., has increased its business over 30 per cent., and the report of the manager is very gratifying. The following testimonial from him indicates the marked success attained there with some of the primitive apparatus used, it being the first municipal station started.

LOCKPORT, N. Y., June 6, 1888.

Edison Electric Light Company, 16 and 18 Broad street, New York:

GENTLEMEN: Our experience with the electric light has been a most instructive and encouraging one. We started more than three years ago to supplement a large domestic gas business and a street system of about 400 burners by a small arc light plant and a small Edison house service. We also secured, as you will recall, the first Edison municipal system which the company placed, the original equipment being 32 lamps of 32 candle-power each. This latter street system was started in March, 1885, and has grown to 140 lamps, with 35 lamps more now to be added. There is good prospect of a continued growth of the incandescent electric service, even in the territory now covered by gas, until in all probability another five years will see the old method entirely displaced. Happily, public opinion coincides with our own desire, for we find that whether for streets or interiors, the sale of electric light is more profitable to us than gas.

You would be surprised to know the results which, with even a small electric plant, have by the aid of economical management been attained.

You are aware that our street system was an experimental one, and errors made in our work have never been repeated, so that our results can hardly be said to more than indicate the great advantages which can, in our opinion, be secured by gas companies in the use of your system as now applied.

We only wonder that gas companies generally have not been aroused by the logic of dividends earned by a few who have tested the value of your methods, and adopted more generally the electric system, not only as an adjunct but as an essential of the business of selling light.

Yours truly, LOCKPORT GAS LIGHT COMPANY,
BY H. J CHADWICK, *Treasurer.*

Jacksonville, Fla., is also adding to its capacity 100 sockets due to the increased demand for the light there applied exclusively to stores.

The present number of municipal stations is 20 (of which 17 are in actual operation and three in process of installation), an increase of over 40 per cent. since the last session. The total capacity in 20 c. p. lamps is over 10,675, and the actual number of lamps burning is 5,200, about 600 of which are used in interiors, the rest for street lighting.

The average price received per lamp, so far as we have statistics, is about $24 per year for street lights of 20 c. p., and about $3 per month for interior lamps of 15 candles. The average hours burning per day is 9½.

In Rochester, N. Y., the present municipal lighting consists of 826 20-candle and 26 30-candle lamps. The average life of these lamps in actual service is from 750 to 800 hours, 9 to 10 lamps of 20 candle-power being secured to each indicated horse-power. Thus it is entirely feasible to get about 200 candles from the power required to run one arc lamp.

In Rochester arc lamps are furnished at 28½ cents per night. The Edison Company are also furnishing five 20 c. p. power lamps for 25 cents, giving in most cases a very marked improvement in distribution by the use of the small incandescent units.

Arrangements have been made by which the Edison United Manufacturing Company takes up this branch of the business through its agents throughout the country.

The importance of placing 20-candle lamps at intervals of 100 to 125 feet instead of 200 to 300 feet, as, in many cases practiced heretofore, was dwelt upon by Mr. Brewster, his distribution being economical and much more satisfactory in densely treed districts than the use of arc lamps, though the Rochester Company are now furnishing either, as may be demanded.

Mr. Jenks afterward gave a summary of the work done the past six months by the Standardizing Bureau, of which he is director.

An interesting discussion was also held on the enlarging field for applied electricity, presenting new sources of income for Edison central stations. Among these may be mentioned, for example, the supply of current by numerous stations for operating telegraph lines.

The Executive Committe reported that they had selected Kansas City as the best locality for the next meeting of the association. This selection was approved. The meeting will be held there on the second Tuesday in February. A number of gentlemen were appointed to read papers on several very important subjects at the next meeting. After further miscellaneous discussion, the convention adjourned.

CONVENTION NOTES.

We are indebted to Mr. J. H. Vail, the secretary of the association, for the above report of the meeting. The association sits with closed doors, and hence the press is dependent upon the courtesy of its officers for an accurate report of the proceedings. Mr. Vail, however, always shows himself most ready and willing to render the position of the press representatives as pleasant and comfortable as possible under the circumstances.

Among those in attendance at the meeting, outside the delegates, were: J. W. Godfrey, A. H. Eddy, M. E. Baird, A. D. Newton, M. H. Barker, F. J. Boynton, C. L. Ireson, A. V. Garratt and R. F. Ross, of *Modern Light and Heat;* F. D. Lockwood, of the *Western Electrician,* and W. I. Barker and T. C. Martin, of THE ELECTRICAL WORLD. Capt. Brophy, Mrs. C. J. Field and Mrs. C. L. Edgar were also among the guests of the occasion.

Mr. J. W. Godfrey, of the New York Insulated Wire Company, made a very effective display of the well known specialties of his company, including the celebrated Grimshaw tape and white core wires. An article that attracted particular attention was his "competition" line wire, which being but little above the cost of ordinary underwriters' wire, has shown itself to possess remarkable qualities of insulation, so that linemen can climb with perfect safety the poles carrying it. Mr. Godfrey says that one good effect of the recent popular agitation on this subject has been to direct the attention of station managers and superintendents to the desirability of superior insulation, and the result is that the high qualities of such a wire as he submitted to inspection were now being prized at their right value.

Messrs. A. H. Eddy, A. D. Newton and M. E. Baird had on exhibition a 1 h. p. automatic Eddy motor running at 110 volts and 1,800 revolutions, and weighing about 300 pounds. There are now a large number of Eddy motors in use, and this on view was a fine specimen of mechanical and electrical workmanship. Current for it was supplied by a small generator connected up with the engine of the hotel which is employed nightly to run the private arc light plant of the Brush system illuminating the hotel and grounds. The motor was carefully studied by most of the delegates, one of whom, Mr. E. B. Greene, of Altoona, reported very favorably as to its performance, there being various sizes, from ¼ to 5 h. p., on his circuits. The exhibit included also the new Heath speed indicator described in our issue of Aug. 4.

This was put to frequent trial during the convention, and it looked as though pretty well every member carried away one with him in his pocket. Should this indicator prove durable, as it promises, it is destined to be in the greatest demand everywhere.

Mr. W. H. Barker, of the American Tool and Machine Company, Boston, was on the ground in the interests of their belt controller for dynamos. This apparatus has been illustrated in our columns. The dynamo is placed right over the main shaft, in a square frame-work carriage, and is moved to or from the shaft by a hand-wheel, so that it can be very conveniently stopped or started or given the right tension of belt. A large number of these are already in use on dynamos.

Mr. C. L. Ireson had the pleasure of hearing several of the members say kind things about his link belting, about the excellence of which there appeared a practical unanimity of opinion. Not only is it altogether in use in the renovated Edison station in Boston, but President Beggs, of the New York Edison Company, has ordered it for his big new stations in this city.

An interesting exhibit in the convention chamber was that of a new insulating staple, whose use was exemplified in a large number of moldings. There will, we think, be a brisk demand for this article. It is, we believe, already exclusively in use on government work done under the Edison system, and probably others too, as the use of metal staples is forbidden. With the use of metal there is risk of contact, and consequent short circuit, but with these that danger is avoided. The staple seems to be made of very tough fibrous material, and certainly bites into the molding or other woodwork with great tenacity. The staples can be had in any color to match the wood, and are easily handled by the wirers. Altogether these staples deserve patronage, as one of the little things upon which so much of the efficiency of an installation may depend. We understand that they are being made by a Brockton concern.

One of the subjects discussed in the convention was the use of the current from central stations for telegraphic purposes. It happened that the issue of THE ELECTRICAL WORLD of Aug. 11 contained an illustrated article on this subject, describing Mr. F. W. Jones' admirable dynamo telegraphic plant at the Postal Telegraph Company's headquarters in this city, and that number of the paper was therefore in demand, as showing what could be done in that line of work. A copy of the paper was posted up in the convention room by some of the members for general use and reference.

A word of praise is certainly due to the convention as a body of workers. The members had barely reached the place on Wednesday before the convention began its business. A short recess was taken for dinner, and then work went on again till well-nigh dark. No sooner had supper been disposed of than there was a full muster to hear Mr. Jenks on lightning and its effects. To this visitors not in attendance as delegates were courteously invited by the secretary, Mr. Vail. Thursday morning business was resumed at 9:30, and the ball was kept rolling till 1:30. Dinner was hastily swallowed, and then the convention began again about 3 P. M., and kept it up till 6. Right after that, as soon as could be, the members took a dip in the sea, bolted their supper, rushed for the boat, and spent the evening studying the various details and improvements in the new Edison station in Boston. Some of them stayed over until Saturday to repeat the inspection. If any one wants to go junketing, we respectfully recommend them not to build their hopes too high when they visit an Edison convention, for they will find themselves in a body of men, whose time, like their current, is disposed of on a meter basis.

An invitation was extended to the association by the Boston Electric Club, to visit its quarters and use the club facilities, and several members availed themselves of the opportunity so kindly furnished.

The Protection of Electric Light Stations from Lightning.*

BY W. J. JENKS.

Early in June a circular was issued from the Standardizing Bureau office to each Edison illuminating company, asking what method of protection, if any, had been adopted

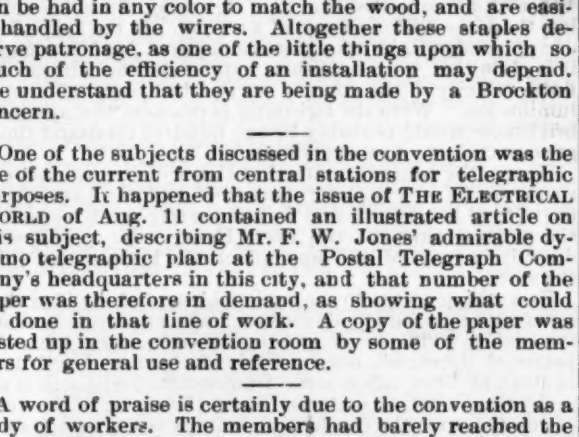


FIG. 1, 2, 3.—ACTION OF LIGHTNING DISCHARGE.

and what results attended its operation. Up to Saturday night, last, answers had been received from 59 central stations, demonstrating the lively interest taken in the subject and the fear of a peril little understood and possibly very difficult to guard against.

I shall have time to-night to consider only very briefly and imperfectly some possible causes of the almost unaccountable freaks of lightning flashes. In endeavoring to illustrate the more common, I shall refer to the remarkable experiments made and papers read within a few years by Prof. Hughes and within a few months by Prof. Lodge the latter being recently illustrated before the Society of Arts, of London.

* Abstract of a paper read before the Association of Edison Illuminating Companies, Nantasket Beach, August 8, 1888.

I have shown some of the results which have been produced by a charge carried without any serious heating of a No. 12 B. & S. iron wire. Also the prodigious energy expended in the twinkling of an eye by a current of sufficient ampères to melt what was probably a poor joint or a corroded spot in a solid rod half an inch in diameter.

It is probable that no matter how peculiar the track taken, the lightning always follows Ohm's law strictly, choosing the line of least real resistance. Several paradoxes at once appear. It is observed that in cases of burn-outs of armatures the lightning spark appears to jump from one commutator bar to the shaft, and so to earth or perhaps again from the shaft to an opposite bar, escaping by the conductor of opposite polarity. Or, if it pierces the insulation of the coils, it usually jumps from an outside wire nearly midway of the length, through intervening layers, straight to the core or shaft, but without following the wire through a circuitous route. This is shown graphically in the sketches, Figs. 1, 2 and 3, the first showing the armature construction, the second a relay, say, of 5 ohms, shunted by an air space of ¼ inch, and the third a loop of heavy copper, its ends close together. All embody the same idea, that of the enormous increase of the resistance offered by a conductor to the passage of a current through electrical inertia or self-induction.

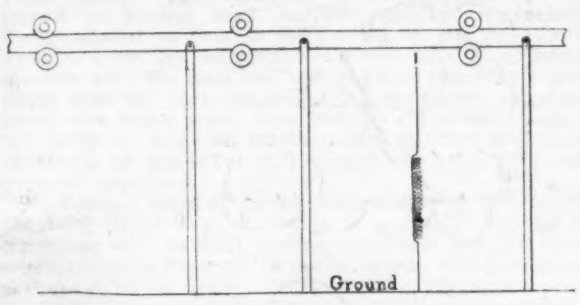


FIG. 5.—SIDE FLASH.

Water in a pipe cannot be started into rapid motion in an instant. A very quick and violent blow upon the water may burst the pipe but will not propel the water. If you apply enormous power suddenly to the piston of an engine having a driving pulley weighing several tons, you may break some portion of the machine, but the inertia of the wheel must be gradually overcome. So it is with a rush of such inconceivable velocity as lightning, for we must remember that practically, and for aught we know absolutely, the E. M. F. of any electrical flow is simply its velocity, and a tension of 1,000,000 volts means that the impulse is toward a velocity 1,000,000 times as great as with one volt. The flash occurs, and with such suddenness that the metallic particles cannot adjust themselves to transmit the motion as quickly or as easily as a narrow air space. Hence, while the resistance offered by a heavy copper loop to a current of low velocity is as nothing, its resistance to a momentary discharge of very high velocity may be beyond our power to compute, and a side flash takes place to any available conductor.

Again, let us consider the stored energy of a highly charged thunder-cloud as analogous to the pent-up forces of a steam boiler at high pressure. Liberate either and rapid motion results. The energy of each can be expended only in one way, namely, as arrested motion, and the energy of arrested motion always appears as heat. If we give the steam a broad free opening, its velocity of expansion is frightful, and after the first impulse it recoils and surges and oscillates back and forth until its energy is dissipated. If the opening be small and the friction of the discharge be great the high pressure of the minute jet will be gone by the time it meets the outer air. So with the electric discharge. The outburst of great velocity recoils along the conductor and oscillates back and forth until its pressure has gone into heat and equilibrium is reached. There may be millions of these oscillations in a second, for they all take place within the $\frac{1}{1000000}$ of a second, which represents the duration of the discharge.

One more surprising thing has been developed from the theory of Clerk-Maxwell by Professor Hughes, Lord Rayleigh and others, and clearly stated by Professor Lodge. It is that when a current starts in a conductor it begins on the outside, and gradually, though rapidly, penetrates to the interior. A steady or direct current, once started, flows uniformly through the whole section of a conductor; an oscillating or alternating current does not. It is started first at the surface, and it is stopped there first. With rapid alternations then, lightning cannot penetrate below the skin, as it were, of the conductor. In this outer skin of microscopic thickness electricity may be oscillating while the interior is idle, and the real conducting substance is confined to the surface. This is a fact distinct from the old one, that static charges dwell only on the surface.

These are indeed curious kinds of resistance, but their influence offers enormous obstruction to lightning currents. That we may appreciate how great this obstruction is, let us suppose five wires suspended by silk around a room. Each wire is 40 feet long, and they are successively connected to the main leading wires, at the points *C* and *D*, Fig. 4. A sudden impulse as from a Leyden jar, is then sent through, and the current has the option of going either one of two ways, through the loop of wire, or across the knobs *C* and *D*. In Prof. Lodge's experiments with a constant E. M. F., and with resistances as in the diagram, the distances which sparks would jump are also shown.

Two surprising hindrances are here apparent, the electrical inertia, which does not act as resistance, by using up energy and radiating heat, but causes a dodging or side flash, and the similar effect of a throttling nature resulting from surface action, which does dissipate energy as heat. These combine their forces to resist the passage of lightning along the best of conductors.

How, then, may we best guard against this, until recently, unsuspected effect?

1. By making the conductor in the form of a ribbon instead of a rod. This advantage can be approximated by using strands of fine wires. Experiments show very little difference with conductors of small size, so far as melting with large currents is concerned, but this is not the point. With lightning there can be no time for surface cooling. If the conductor has literally too much current to carry it will melt instantly, no matter what its surface as compared with its mass. The difference between a tape and a rod is shown to be at least 25 per cent.

2. By making it of iron in preference to all other metals. Fig. 4 shows that absolute resistance plays a very small part in this matter. It may be objected that iron has more self-induction than copper; that is, a current going through iron has to magnetize it in concentric layers, and this takes time and develops inertia.

It appears likely that the alternations are too quick to magnetize the iron, or the current operates so entirely on the surface that there is nothing to magnetize; at all events a coil made of tin-foil requires the same E. M. F. to give the same length of spark when it is placed in the circuit of a Leyden jar discharge, whether it has a bundle of fine iron wires as a core or not.

Even with these precautions, side flashing and jumping from the rod, as shown in Fig. 5, cannot be entirely stopped. No matter if it be made a foot or a yard wide, the increasing of resistance in a side path serves not to stop the flashing, but only to weaken it.

3. One more remedy suggests itself, viz., giving the conductor as much capacity as possible. Such a condenser as Mr. Edison suggests provides a very large surface for interchange, a storage ground, as it were, where the energy can be momentarily accumulated by charging up the plates, and the violence of the disruptive spark somewhat broken. If by any means we can thus slow down the velocity of the discharge we avoid much of the danger of the side flash, which punctures our armatures and allows the line current to follow and melt them.

In this connection a most interesting diagram may be briefly explained. When a gradual charging has taken place, and a ground wire or rod is awaiting the flash from the cloud, we have an effect which may be described as "steady strain." The conditions of one experiment are outlined in Fig. 6. Here the discharging power of points is graphically shown. The flash actually preferred to jump three times as much air and encounter a megohm resistance rather than take the short direct path offered by the equivalent of a large knob (about 2½ times as large in diameter as the smaller one). If we interpose into one of the conductors a resistance, equivalent to a bad ground connection, we find that up to a certain point the worse a conductor is, the quieter (and less explosive) will be the flash (while the energy or heating effect remains substantially the same) and the protection, if the current is led to the right spot, will be as good. The potential which has to be absorbed or used up, is expended more gradually.

But often the clouds spark first into one another and then as a sort of recoil, into the earth. An upper may spark to a lower, and instantly this overflows into the earth, and the conductors previously uncharged do not have time to prepare any carefully chosen path by induction This is a sudden rush and the effect is radically different. The best and highest conductors will be struck with equal ease no matter what their shape or size, and probably all three will be struck at once. Now insert resistance into one and its protective power disappears. It may even penetrate the cloud, but it assists very little, if any, in discharging it. So a bad ground cannot protect against these explosive discharges.

Where a bolt strikes a system and discharges at the central station, it rushes to the ends of the system, for instance, to the open ended conductors, such as spur mains, brings up with a tremendous water hammer action, surges back like water in a pipe, and thus expends an enormous amount of energy before it settles to an equilibrium. Hence complaints are frequent that these long spur mains especially have lamps exploded, plugs fused, insulating joints punctured and flexible cords short-circuited by lightning. Imagine a rubber hose, somewhat elastic, pumped very full of water, and its ends closed with spring valves. If one end is suddenly opened and as suddenly shut, a pulsation or recoil is sent back which may force open the valve at the farther end and let some water escape. Thus the electricity when a flash strikes the lines goes rushing and surging about everywhere for no apparent reason, just as water surges about in a canal, splashing and overflowing its banks when rocks are dropped in. Bell-wires, gas-pipes, gutters, chains, bars and bolts take side flashes from the main conductors in a most bewildering fashion; thus gas ignites in most unheard of places, and passengers in a train may feel a shock because a charge has struck the rails. Even the hinge of a door or

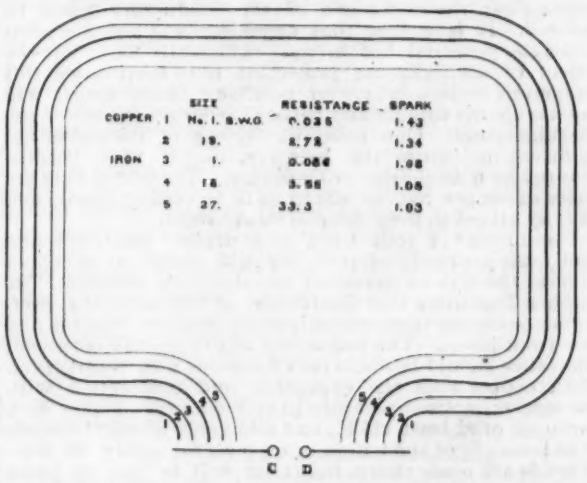


FIG. 4.—COMPARATIVE RESISTANCES TO DISCHARGE.

an isolated nail may call a spark from nobody knows where. This manifestation of electrical inertia may even cause a secondary flash from the distant end of a conductor longer than the original spark, and the reason for what we are accustomed to regard as return strokes thus becomes plain.

Three kinds of damage may be said to be done to our electric light systems by lightning discharges:

I. Disruptive damage, or the expanding and explosive violence.

II. Melting or fusion by heat of the current or the arrested motion, which we may term the result of electric inertia.

III. By breaking down the insulation of apparatus, lines and fixtures, and establishing a bridge of vaporized metal or heated gas, which is followed up by the working current

of the system. When a very good conductor is provided, except at a very few points, the disruptive or explosive action is commonly manifested at these intervals. When the general track of the tension resulting in a discharge is one of very great resistance the flash appears slower and the heating effect is more pronounced.

Some of these effects have taxed the ingenuity of the brightest theorists in this field. A recent writer thus aptly expresses it: "When conductors fail it is customary to say they are not properly made, or that there was a faulty joint, or that there was a bad earth. A bad earth is the favorite excuse. A good earth is a good thing undoubtedly, and one cannot well have too much of it, but for the flash to leave a fine thick copper conductor on a pole or chimney while still high up, knocking holes in the brick in order to make use of the soot or the smoke or some bolts or other miserable conductors of that sort, because it is not satisfied with the moderate allowance of earth provided for it at the bottom, is evidence either of simple perverseness or else of something more deep-seated. If the earth is bad the flash may show its disgust when it gets there by tossing it about and boring holes into it, and breaking the water and gas mains. But at least it might leave the top and middle of the chimney alone, and wait until it got to the badly conducting place before doing the damage. It is supposed with one breath to strike the conductor because it affords an easy path to earth, and with the next it is said to leave the conductor because, after all, it finds it a bad one. Besides, it need not be so very particular about a little resistance. It has already come through, say, half a mile of clear air, and we may suppose that it might manage a few feet of dry soil. It is not possible to have too much good earth except on the score of expense. But even if it were so good an earth that it may be almost called a heaven, it would not stop the tendency to 'side-flash.'"

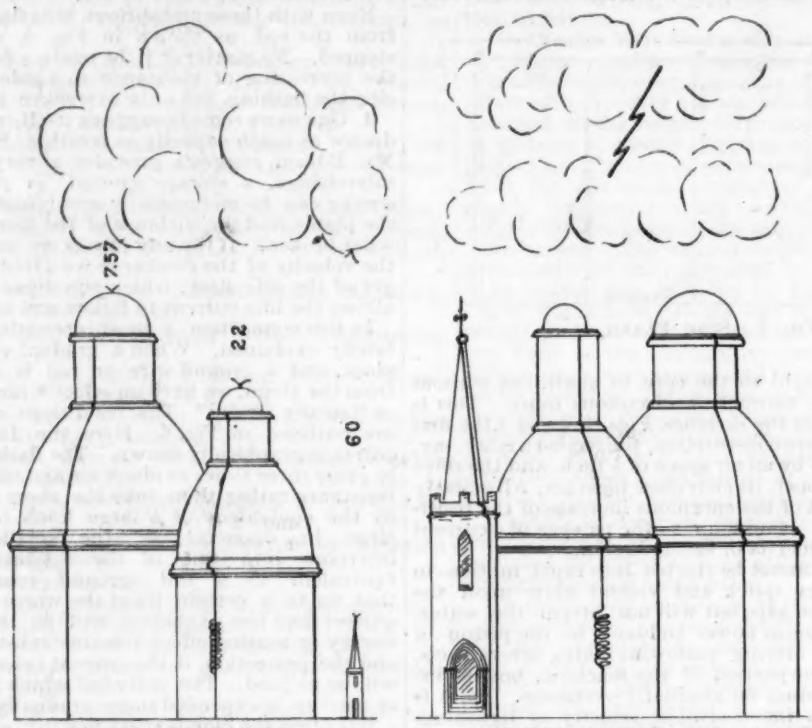


FIG. 6.—PROTECTION OF BUILDINGS FROM LIGHTNING.

A ground connection is desirable to prevent damage to pipes, foundations and everything buried therein, but so far as getting rid of the flash is concerned it ought to suffice if the conductor was cut off level with, or even a foot or two above the proper locality on the ground.

To sum up regarding the construction of conductors for the protection of chimneys, station buildings and lofty poles: First, the upper end of the conductors should be pointed. It is a fact that anything will act as a point when the potential has become sufficiently high, but the object of all lightning protection is to keep down this dangerous tension wherever possible. Sharp points will radiate energy rapidly and reduce the strain far below the sparking point. One point at the top of the rod is not sufficient to insure the best results. It may become blunted by a discharge or tarnished. The best points are cones of copper not so sharp as to be readily fused, and heavily gilded to keep them always bright.

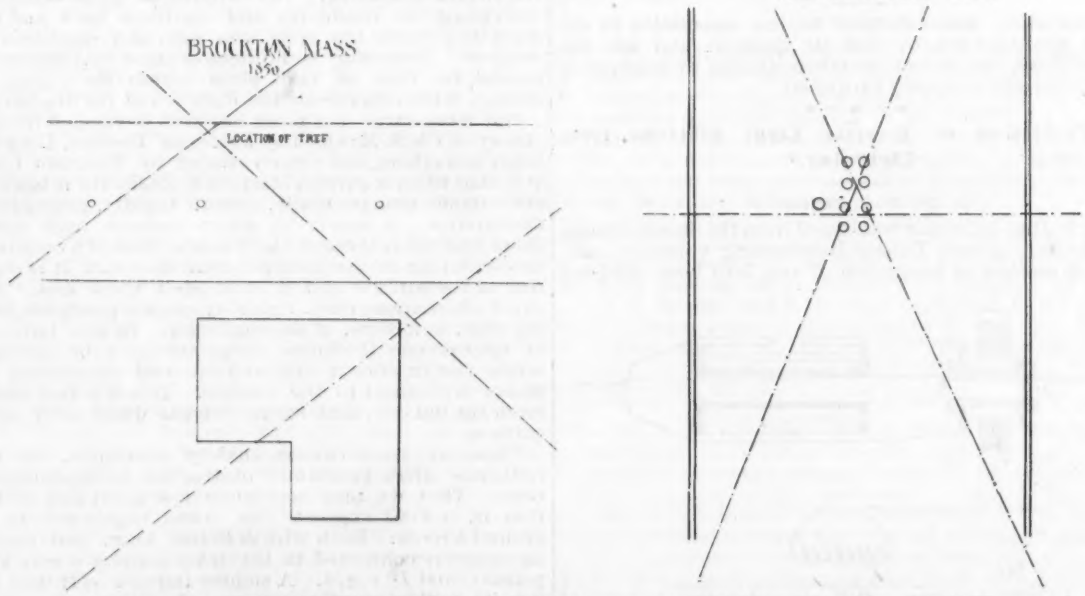
Three forms of rods have been widely produced and each quite generally adopted, viz., the round bar of copper or iron, the rope or stranded metal and the ribbon. The English Lightning Rod Conference of 1882 gave the preference to copper tape, which is easily handled, flexible and free from joints. The rod should not be readily corroded; allowance should be made for expansion and contraction. With copper rods the expansion and contraction with the extremes of temperature in this country is due to a variation of at least 125 F., and allowance should be made of at least $\frac{1}{10}$ of the length or an inch for every 40 feet. If bends are made sharp, lightning will be apt to jump across instead of going around the bend. Flexibility is convenient, but should not be too much relied upon, inasmuch as a straight track to earth is one of the most desirable features of the main leaders of a rodded system. If lightning is led to jump across instead of coming through the entire length of the conductor, melting will probably take place, and any sparking between the upper ends of the rod and the ground connection is always a serious danger. The main difficulty with poor joints is the tremendous heat developed, with the liability of fire communicating to any combustible material.

Perhaps the most vital portion of any street system of lightning protection is the connection established beneath the surface of the earth. If we proceed upon the basis of the theory of powerful attraction to localities or lines of electric tension, it is essential that we either connect directly with these channels or terminate our conductors so that the descending charge shall reach them by the most direct way possible.

Imperfect Ground Connections.—In 1878, before the days of cheap magneto call bells, I had occasion to connect the shooting station of a 1,000-yard rifle range with the markers' pit at the targets by a telephone line. The wire was No 12, iron, substantially erected on poles. The ground at the shooting shed, a plate one or two feet square, in a small stream, was undoubtedly good. After passing over the 3 000-foot interval and through the target instruments, the line was carefully connected with an inch iron bar driven from 3 to 4 feet into the ground at the bottom of the pits. To my amazement four freshly-made Daniell cells failed to operate a single 25-ohm tap bell over this line. Four more showed no better result. A third installment, making twelve in all, wouldn't make the bell wink. A second iron rod was added and both together driven into the clayey soil failed to operate. Another branch to a third rod a hundred feet down the side hill was likewise ineffectual. Any one of them would work the telephone, but we had to run a return wire back to the station to make a reliable circuit, and then the two bells were easily operated over the 6,000 feet of wire with two cells of battery. The entire slope, perhaps the tree-crowned hill behind it, was highly insulated from the arteries leading to the electrical reservoir below.

There are whole valleys in the Lake Superior copper region thus electrically isolated from the earth's channels, and it is said that lightning has never been known to strike them.

A noted European electrician who spent years in cable work once told me a story almost incredible as to this peculiar condition of localities on the earth surface. A trans-Atlantic cable has been laid on an island off the Irish coast, and here the repeating station was to be placed—the point where the language of the shadow signs or the siphon recorder is translated into Morse dots and dashes. The usual ground plate of copper, about 5 or 6 square feet, had been buried in the scanty soil which bounded the rocky coast. The battery was applied but no signal went out. Beyond question the cable itself was perfect. Another plate of 10 square feet was buried just above low water mark in the sand. This gave a current so faint that it could barely be perceived. Still another plate 6 feet square (36 square feet in area, or on both sides 72 square feet of exposed surface) was covered three feet deep in sand and mud. Still no practical result. The expert was staggered. Delicate Thomson galvanometers were barely deflected by a hair's breadth. In disgust he tried once more, this time taking several pounds of shingle nails and, uncovering the broad face of the copper sheet, drove the nails through, about half an inch apart, over its entire surface. Then the hundreds of nail points and thousands of minute slivers and crystalline faces of copper exposed to contact with the earth and water made a connection of so low resistance that the current flowed freely through with perfect results.



FIGS. 7 AND 8.—LOCATING POINTS OF LIGHTNING DISCHARGE.

One more illustration from telephone experience. In 1880 the American Bell Telephone Company began to license the construction of "extra-territorial" lines, connecting widely separated exchanges. One of the first was built for the Inter-State Telephone Company from Boston, the cradle of the telephone industry, to Providence, by wire 50 miles. The construction was most substantial, and it was expected that in a short time the magnificent line of 40, 50 and 60 foot poles would carry the 50 wires which were provided for. It was at that time a theory with the "experts" that interference or cross-talk was merely leakage, and so to carry away the currents which by any means might creep over the glass and its support, a sheet-iron collar was arranged to surround the base of each pin and connect with a wire under the cross arm joining another leading down from the point of the pole and winding several times around its base. Here it was supposed to make a perfect earth connection. Measurements showed the resistance of these grounds to be all the way from 100 to 3,000 ohms each. Occasionally where the soil was very wet the results would be better, and of course even the worst of such grounds will avoid the destruction of the pole by the splintering from top to bottom which often occurs where the current can find no better conductor than the moisture in the pores of the wood.

Whatever may be the retarding influence of poor conductors upon the intensity or explosive action of a discharge, it is certain that at all times the duration of the lightning flash is inconceivably short. This is illustrated by the fact that the rapidly revolving spinning wheel is seen by the lightning flash as if perfectly stationary. Wheatstone estimated that the lightning flash occupied less than one-millionth part of a second. As the full effect of any sudden light upon the eye requires $\frac{1}{10}$ of a second, it is plain that we can neither appreciate the almost infinite velocity of the current nor the brilliancy of the illumination. Were the lightning permanent the apparent brightness would probably be one hundred thousand times greater than we now experience.

Hence, the common statement that the direction of the spark can be seen is plainly incorrect, and must arise from the optical illusion excited by the greater sensitiveness of the central parts of the eye. Hence, the point seen directly in front of the eye affects the brain sooner than the rest.

Everything points to the reasonableness of the idea that other things being equal, certain lines or points beneath the surface strive to interchange their energy with the points of the clouds most densely charged, and will do it in straight lines unless some tremendous resistance is set up by an insulating material, or by the action of the rush of current upon the conductors in its way. A vast system of water pipes which affords the best possible ground connection for all circuits of low pressure, sometimes proves entirely inadequate to discharge the tremendous energy of the thunder cloud without a rupture of the iron mains.

A flash that finds its way from a small wire into a network of iron pipes, may, in leaving that net work at a certain point of maximum attraction, rend the metal asunder with an explosive force which we can only estimate, and cause disastrous effects in the system. These, of course, are the exceptions.

Gas pipes should not, under any circumstances, be used as grounds, except as connection may be made outside the meter; in fact outside of all joints within buildings, because the leaded joints themselves are likely to offer resistance, and induce a spark which may fire the gas, or a melting action which may entirely open the pipe, and cause the firing of combustible material. A melting out of the meters is often traceable to this cause.

One of the best earth connections may generally be made by a copper plate from 3 to 6 square feet in area, so placed at the bottom of a well that it will come into intimate contact with the soil itself. Another very desirable form may be arranged by burying a large quantity of gray retort carbon or charcoal in damp soil, and this again may be still farther improved by leading to this bed of carbon a water spout from the roof. In many cases it is possible to get a most desirable form of ground connection by burying a large plate at the terminus of a drain or in the bed of a stream. That the stream alone, however, cannot be relied upon as affording a distributing channel has been more than once demonstrated. Here is an illustration of an instance which came under my own observation. A forest tree was struck and partially shattered, the charge leaving its trunk some six feet from the earth, running along the surface, deliberately jumping a stream at least six feet in width and plowing up the earth beyond for some distance, finally boring a hole vertically over what was presumably a subterranean water course, or similar line of attraction.

The most desirable method in an electric light station, or in fact in connection with any building to be protected,

is to connect with as many good grounds as are available. From the centre of distribution, or lightning arrester, a ribbon of copper or galvanized iron, say $\frac{1}{8}$ inch thick and an inch wide, should take as straight a route as possible to the points of contact with pipes or ground plates. Smaller copper tapes may lead from the main ribbon to each of the connections, and, after making the contacts bright, they should be carefully soldered, and the whole may then be covered with tape or other convenient insulation. It is always better in stations or dwellings to insulate these ground wires on porcelain or other non-combustible material, so that in case of corrosion or any accident, the setting up of an arc between the disjointed ends shall not fuse wood or other combustible substances near them.

In the case of rods, however, on the outside of buildings, insulation is generally not only unnecessary but foolish and possibly dangerous. With few exceptions, all metallic surfaces or masses employed in the construction of buildings should be carefully connected with the rod itself; one very important object is thus to attain the keeping of all the metal surfaces of the building at the same potential as the earth, and thus giving the lightning flash a large capacity for conduction to ground.

The exceptions to connecting iron about buildings with the rods which protect them have been noted by eminent authorities as balconies or other masses of metal upon which people may stand at the time of electrical discharges, and thus form terminals to receive the flash on its way to earth.

An occasional test of the earth connections is one of the important things to the central station manager. The most carefully made grounds may become disconnected by corrosion or mechanical injury of the conductors. Siemens has suggested a valuable method, which, though somewhat complex, can be readily mastered and applied in a practical form. A simple way is to so arrange the rigid ground wires as that a galvanometer and Leclanché cell can be readily connected with two independent grounds, and by a deflection when the conductors are so coupled as to complete the circuit through the earth, show at any time whether any change in their resistance has taken place.

But the intelligent manager will not rest here.

Another quotation from the recent valuable and practical paper by Prof. Lodge is here very pertinent: "It is a mistake to place the whole reliance on the testing of conductors with a galvanometer and Wheatstone's bridge. A galvanometer is powerless to answer many important questions. A Leclanché cell can no more point out what path lightning will take than a trickle down a hillside will fix the path of the avalanche. The one is turned aside by a very trifling obstacle, and really follows lines of least resistance. The other crushes through all obstacles, and practically makes its own path. The flash strikes a house at one corner, rushes apparently part way down the conductor, then flashes off sideways to the roof gutter, sends forks down all the spouts, and knocks bricks out. Another branch bangs through the wall in order to run merrily along some bell wires, and then out through a window frame, and down a spade or something propped up against the wall to earth. The lightning tester comes with his galvanometer and Leclanché cell, and reports that the earth conductor has 100 ohms resistance, and the accident is, therefore, accounted for. But how much resistance would he have found in the paths which the lightning seemed to chose in preference to the 100 ohms? Something more than one million probably. Or perhaps there is a bad joint in the conductor somewhere, the parts being separated by one-sixteenth of an inch. But why should it prefer to jump several yards and knock holes in walls and windows rather than jump one-sixteenth of an inch? No. The galvanometer and Wheatstone's bridge and Ohm's law of conductivity are simply not in it. Something has been left out of consideration, and until that something is fully taken into account no satisfactory and really undeniable security can be guaranteed. That something is *electric inertia* or *self-induction*."

The form of arrester most suitable for the protection of central station apparatus has for the past six months been the subject of much careful thought. The peculiar experience of many central stations, and particularly of those which have adopted the Municipal system, seemed at first only to add complexity to the problem. The extraordinary precautions taken in insulating this system of widely radiating lines, have demonstrated in the first place that these lines, covering sometimes several square miles of territory, serve as a gathering ground for charges which often concentrate at the dynamo or act as connecting links through the dynamo between the widely separated clouds. In some cases where armatures have thus been destroyed, it seems to be impossible to account for the peculiar features on any theory except that there was no special tendency to jump to earth, but that the current used the dynamo only as a connecting link between the widely separated points brought near together by lines of wire diverging from the central station.

Feeling that this was one of the questions upon which the most exhaustive study should be extended, the matter was some months ago referred to Mr. Edison, and upon thinking it over carefully seemed to him clearly analogous to his experience in the case of the protection of the phonoplex telegraph system from lightning. This has always been found a difficult matter in the same way that the protection of the system of alternating current transformers has thus far proved an unsolved problem. The condenser which is necessary to the action of the phonoplex, with its plates of large capacity separated only by a thin insulation, seem to invite the atmospheric discharge toward the easy channel, and then when the capacity of the condenser was filled the arrested energy found its way in a flash through the insulation. Thus, also, large numbers of converters are on record as having been burned out by atmospheric flashes almost as fast as they could be put up. In the dynamo armature considerable surfaces of wire connected directly with the lines are brought into immediate proximity with the core, the shaft, the bus frame, and sometimes with water pipes, thus inviting a flow of current to the point of weak insulation. Mr. Edison's idea is the providing of a point of still weaker insulation before the dynamo is reached.

No definite form of future central station arrester has yet been decided upon, but it is probable that the air condenser will be used, having numerous ground plates separated from those of the line by a very small air space, perhaps $\frac{1}{64}$ of an inch. In case of a discharge which might be followed by the line current, a fusible wire will be used, situated so as to melt and open the circuit before damage could be done.

The fuse can be instantly replaced even while the shower is in progress, or if necessary the arrester itself can be changed in a few seconds. Working models embodying this idea are soon to be sent by Mr. Edison to some of the stations which have been most afflicted, for practical trial.

In addition to this central station protection applied to the bus bars as a distributing point for a general system, it is very desirable that arresters be placed at several points on the conductors of a three-wire or midway of the resistance of each circuit of a municipal system of any size. It is suggested that one three-wire arrester be placed on each section of main in some convenient and accessible building where a ground which is unquestioned can be readily secured. This special arrester will also be provided with fusible cut-outs enclosed in a porcelain case sufficiently ventilated to prevent any breakage by explosive action, and to prevent a possible communication of any fire from an arc. With a dozen or 20 of these small arresters, which can be periodically inspected after severe showers, in addition to a central station arrester, it is pretty evident that our stations will be protected far better than heretofore, to say the least.

Interesting Effects of Lightning.—It is only within a few years that the wonder-working influences of the thunder-storm have been appreciated. The beneficent part which it plays in the economy of nature may well increase our interest in its many phases and call forth our admiration of the wisdom it displays. Once the lightning was thought a sign of the frown of an angry deity, now it expresses to us the powers of a reviving agent, working good to all mankind. Radical modifications are made in the elements of the atmosphere. Gases simply held in suspension are combined by the electric spark and form new substances which descend in rain to fertilize the soil. Each discharge engenders in the atmosphere fruitful principles of life, which are absorbed by animals and plants. The passage of the lightning transforms oxygen into ozone, which is often produced in the laboratory and which destroys miasma and neutralizes putridities. All the imperceptible remains of organic matter are consumed on coming in contact with electrified air.

In the eloquent language of Peltier: "These convulsions of nature seem necessary to re-establish the equilibrium of the atmosphere. Dense, stagnant fogs, that cause disease, are dispersed; abundant rains re-animate life and spread freshness on all sides: the air becomes pure and light: renewed by electrical action, it restores vigor to men and animals exhausted by the overwhelming heat of the burning season, and gives back their brilliant verdure, and their vitality to absorb poisonous gases, to the wilting plants. To the commotion of the hurricane, the howling tempest, the torrents of rain, the lightning and the thunder, succeed the serenity of the fine weather, the calm, the pure light, and the beauty of an incomparable spring."

Mr. Jenks introduced his paper by an historical sketch on lightning and some of the peculiarities and theories of its nature. With regard to the latter he said:

One theory which has within the past few years received some credence is that subterranean water-courses are invariably found to constitute points or lines of attraction representing the earth's electrified condition, and that these water-courses or channels may be indicated by certain people by that mystical device known for hundreds of years as the "divining rod." While not definitely advocating this theory, or attempting by it to account for many of the freaks of lightning, it may not be out of place for me to illustrate by a few instances, within my personal knowledge, the accuracy with which an operator of this peculiar apparatus has indicated points to which lightning has in past years directed its attention.

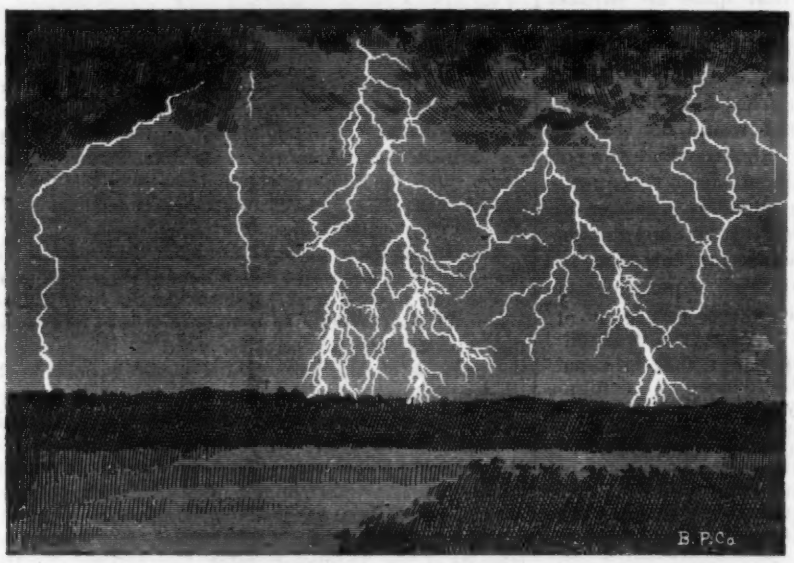
In Brockton, in this State, an experimenting operator noted in front of a house and within the present limits of the street, three of these lines crossing each other some distance outside the present limits of the sidewalk. The owner of the house, coming out and watching curiously the motions of the experimenter, inquired what he had found, and to my surprise stated that at the point which had been indicated as the junction of the lines of force, a tree had been shattered some twenty-five years before, then on the edge of the side walk, the street having since been widened. This is shown in Fig. 7. He remarked at the same time that on the hill near by another stroke at the same instant had killed a man then residing there. Repairing at once to the house, two lines were indicated, one traversing diagonally the place occupied by the foundations and passing directly under the door stone of the old mansion. The owner, a gentleman 75 years old, coming out as had the other, to inquire what was being done, and being told that we were looking for localities where lightning might at some time have struck, stated that the man who had been killed was standing at the front door, looking out as the shower cleared away, exactly over the line indicated by the divining rod. The other current or line of attraction leading back of the residence seemed to be quite as strong in its attractive force upon the rod, and as we followed it through, the old gentleman turned up a broad, flat stone, and showing splinters and chips of decaying wood, stated that a forest pine formerly standing where the stone had lain had been shivered by lightning.

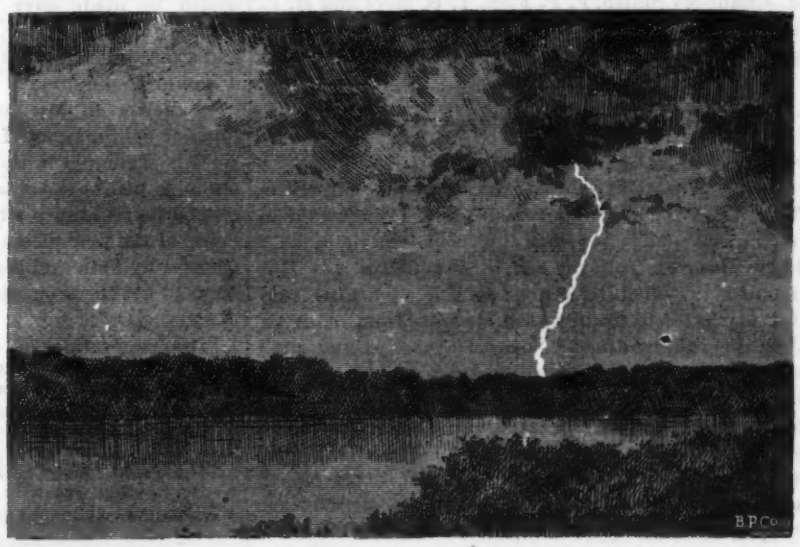
Several of the old citizens of Amesbury, skeptical as to this method of determining where lightning might strike, conspired to put this to a severe test. Taking twenty or more citizens as witnesses, they requested the exponent of the theory to accompany them, and indicating a stretch of highway some 40 or 50 rods in length, stated that some years previous the lightning had struck on that road and wished to know the exact spot.

Proceeding several rods, two lines were marked out, both extending for some distance in the traveled pathway, and crossed by a third at nearly right angles. Testing the road carefully in both directions, this electrical centre was pointed out as the spot of greatest danger, and shown in Fig. 8. The party was then invited to examine an ancient volume of official town records, wherein it was chronicled that on the 7th of October, 1802, a man who was driving two yoke of cattle was struck by lightning in that exact spot, and with his four animals was instantly killed. The occurrence had been deemed at the time so remarkable that the circumstances, with a minute description of the locality, had been recorded, though long ago forgotten by all except, perhaps, a few of the oldest citizens.

It is a curious fact regarding the operation of an apple, peach or hazel twig in the hands of a person apparently specially endowed by nature with something akin to mesmeric power, that it will work equally well if held at one end by such an operator and at the other by a person not susceptible to its peculiar manifestation of energy. It is also singular that no action of this device can be secured if the operator be insulated electrically by rubber boots.

Mr. Jenks exhibited the sketches by means of the lantern, and also showed by the same means instantaneous photographs of lightning, among them that illustrated in a recent issue of THE ELECTRICAL WORLD, and the two shown in the accompanying engravings, Figs. 9 and 10, taken by Mr. Binden, of the Boston *Herald*, to whom we are indebted for the copies.





FIGS. 9 AND 10.—PHOTOGRAPHS OF LIGHTNING TAKEN AT WAKEFIELD, MASS.

The Electrification of Aqueous Vapor.

MM. Lang and Lecher have lately laid the results of their experiments upon the transferrence of electricity by water vapor before the Academy of Sciences of Vienna. It is generally known that the friction of steam against solid bodies increases its electric charge, and this phenomenon has been made use of in the well-known Armstrong machine. M. Lecher has shown by thermometric experiments that an electrified liquid evaporates more quickly than one in a neutral condition. This, however, is nothing new; M. Mascart and, more recently still, Prof. Exner have shown the same thing. M. Lecher, however, attributes the increase in the amount of vapor to energetic electrical action taking place at the service of the liquid, and which, according to him, renders all thermometric measurements

exceedingly difficult. Others have attributed the phenomenon to the actual electrification of the steam itself, and that the steam is electrified M. Lecher's experiments have shown. These investigations are very important from a purely theoretical point of view, since they tend to throw light on the theory of atmospheric electricity.

An Alternating Current Decision.

We take the subjoined from the Boston *Advertiser* of Aug. 8, with regard to a decision rendered in the United States Circuit Court at Boston by Judge Colt:

Westinghouse Electric Company vs. Sun Electric Company et al. This suit was brought to enjoin the defendants from infringing letters patent No. 351,589, granted Oct. 26, 1886, to George Westinghouse, Jr., assignee of Lucien Gaulard and John D. Gibbs, for improvements in methods and apparatus for the distribution and conversion of electric energy. There are five claims in the patent, the first being for the art or method, and the remaining four claims for the apparatus. One of the questions in the case related to the proper interpretation of the patent in view of plaintiff's disclaimer. As originally drawn, the patent was intended to cover all forms of converters which transformed electric energy. The patent office refused to grant so broad a patent as was applied for and instructed the applicants that in order to avoid an interference they must conform the arrangement of converters to the series system, that being the arrangement shown in an article in *Engineering* of March 2, 1883, which the applicants declared contained a description of their invention. A disclaimer was accordingly inserted. The court now holds that it is too late for the plaintiff to say that the disclaimer means nothing; that by the disclaimer Gaulard and Gibbs were expressly limited to the series system, and therefore that the defendants, who use the multiple arc system, do not infringe the patent. The court accordingly decided, without entering upon other defenses raised, that the bill should be dismissed. Chauncey Smith, F. P. Fish, T. B. Kerr and M. F. Dickinson, Jr., for the plaintiff, and J. E. Maynadier, R. S. Taylor and W. A. McLeod for defendants.

Experiments with Electric Currents on Dogs.

To the Editor of The Electrical World:

Sir: In Fig. 2 of my article on "Experiments with Electric Currents on Dogs" in your last issue, I neglected to show a connecting line between the front relay-contact *f* and the line leading from the dog to the lamps *L*. This experiment is intended to represent the apparatus suggested in my letter to the *Evening Post* of June 19, as required by the rule reading: "No arc light dynamo shall be operated unless provided with means for automatically stopping the production of current the instant a ground connection is made upon its circuit." The tenth to the sixteenth experiments prove that such apparatus would undoubtedly save life, and I again call attention to the fact that nearly all deaths from arc light circuits are caused by ground connections upon the circuit.

In the twenty-first to twenty-seventh experiments, I neglected to state that we had in circuit with the Cardew voltmeter four times its resistance, which was arranged so that part, or all, of it could be short circuited when desired. This will account for the apparently varying constant in the different experiments. The voltmeter was calibrated, before and after its use, and there can be no doubt as to its accuracy. HAROLD P. BROWN.

The Telephone at Brantford, Canada.

To the Editor of the Electrical World.

SIR: Probably a little enlightenment given to "Mt. Royal" on the subject of the telephone and its connection with the city of Brantford would do that electrical historian a deal of good and lessen his evidently enlarged head. And I may say, in the interests of a suffering public upon whom he has inflicted his effusion regarding Brantford and the telephone, that Bell's telephone was first tested over a line some two or more miles in length, connecting Bell's house in the country with the Old Dominion Telegraph Company's office in the city. It was composed of stove-pipe wire, and it took all there was in town at the time. Most of the line was strung on bottle necks, placed on rail fences. The second line I think was constructed connecting Bell's house in town with one of the churches here. As the people of Brantford are justly proud that their beautiful city should be connected with such a great invention as the telephone, I think it is only right that some one should advise our learned friend "Mt. Royal" of the old adage, "Be sure you are right, then go ahead." A BRANTFORD READER.

Electrical Execution with the Holtz Machine.

To the Editor of The Electrical World:

SIR: Would you be kind enough to state in the next issue of your valuable paper the main objections to the use of a Holtz machine strengthened by condensers for the purpose of electrical killing? CONSTANT READER.

ANSWER.—The objection to the use of the condenser in this connection would be the enormous surface which would be required to accumulate a charge sufficient to cause death. Shocks from the Holtz machine and from induction coils giving sparks many inches in length have been taken by persons without fatal effect. The reason for this is that though the E. M. F. is very high, amounting perhaps to hundreds of thousands of volts, the current is exceedingly small, and, above all, the *time* during which it flows is infinitely small. Thus the *work* done by the current upon the body, which is the product of the E. M. F., current and time, is infinitely small as compared with the current forced through the body by a potential of only a few thousand volts, but which lasts for a measurable length of time, such as a second. Therefore while the employment of the condenser might increase the current passed through the body, it would probably not increase the time element, which, as just stated, is an important factor in determining the work done by the current in causing death.—EDS. E. W.

Practice in Dynamo Construction.

To the Editor of The Electrical World:

SIR: In giving the data of my machines I intended to give the main features only, but I see from Mr. C. P. Poole's criticism that some were left out. They are as follows:

No. of machine	1	2	3
Density of current, sq. mils per amp.	270	242	432
E. M. F. in volts	40	40	110
Diam. of armature core	14″	10″	22″
Radial depth of armature core	1.75″	.875″	3″
Distance of armature core from pole pieces	.1875″	.312″	.375″
Approx. area of pole pieces presented to core in sq. inches, total	240	128	440
Weight of dynamo in lbs.	560	275	4,000
Angular breadth of pole pieces	45°	33°	33°

When reading descriptions of dynamos it is seldom that enough data are given to allow of a comparison with others. For instance, two different dynamos are stated to run at 1,000 revolutions per minute, and yet one of them may have a 12-inch armature and the other a 24-inch. Again, one may have a certain current density in the armature coils and another twice as much, but their efficiences or the speed may be omitted.

Now, if we had a recognized list of data by which all machines were described, I think that quite an advance would be made over perspective drawings and agents' claims. If, Mr. Editor, you would draw up such a table and stick to it when describing new dynamos, I believe it would be missionary work among the scientific heathen.

In answer to Mr. Poole's letter I would say that the form of field magnets I have used is that in which the pole piece is presented to the inside and outside of ring, not so much to utilize the alleged "idle wire" as to reduce the magnetic resistance without increasing the angular embrace of the pole pieces. This construction, introduced, I believe, by Fein and used by Sperry and others, does not seem to get the appreciation that its excellences merit.

AKRON, O. ROBERT S. DOBBIE.

[The suggestion of our correspondent, that data published on dynamos ought all to be reduced to a common basis, is a good one, but the only thing which stands in the way of such a desirable practice is the difficulty of obtaining from manufacturers sufficient data to allow of such a comparative tabulation. It is, of course, to be regretted that such is the case, but until it ceases to be so we do not see our way clear to accomplish such a desirable object.—EDS. ELECTRICAL WORLD.]

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Aug. 13, 1888.

The Sawyer-Man Company.

I learn from the management that the recent announcement made by the Sawyer-Man Company in regard to the price-list for lamps, and its exchange of new standard sockets for any other in use, has been attended with very gratifying results. The number of applications has been even larger than was anticipated, and the responses due to the use of THE ELECTRICAL WORLD as an advertising medium form a very large proportion of the whole. The company's facilities are now inadequate to the demand, to say nothing of prospective increase, and the cry for lamps must be met by further extensions of plant for production. The company already has one of the largest manufacturing establishments in New York, and will soon be at the top of the list.

Baxter Motors.

When arc light motors first began to be used, there were a great many who believed that they would not not prove satisfactory, as they did not think that arc lights and motors could be worked successfully on the same circuit, on account of the interference of the motors with the steadiness of the light. With the experience that has been obtained in this direction so far, this belief has been entirely exploded, but if anything more were necessary to demonstrate the absolute success of motors to operate on circuits in connection with arc lights, the letters addressed to the Baxter Motor Company in relation to the action of their motors would be conclusive. Such letters are those from the Grand Rapids, Mich., Electric Light and Power Company; the Binghamton, N. Y., Gas and Electric Company; the North Attleboro, Mass, Steam & Electric Company, all of whom write in unqualified praise of their high regulation and their ease of operation with the arcs.

The Julien Company.

During the past week the Julien Electric Company have installed on the steam yacht "Stranger," belonging to Mr. Geo. S. Scott, an accumulator plant of 50 Julien cells. They are particularly convenient in a case of this sort, as they enable lights to be kept burning through the evening and night after the boat has come to anchor, and also make it possible to have a double illumination in the case of lighting the exterior of the boat. They are also installing a very complete plant in the house of Mr. T. H. Porter, Stamford, Conn., consisting of a Baldwin gas engine, small dynamo and storage battery. In addition to the lighting of the entire house, the current from the batteries will be used for running small motors and probably for passenger elevator. The Northwest Electric Construction and Supply Company are installing in the house of Mr. W. S. Jackson, Prairie du Chien, Wis., an electric light plant, using the Julien accumulator.

Dynamo Telegraph Belts.

In your last issue mention was made of the fact that Underwood cotton-leather belts are in use in the new Postal Telegraph dynamo plant. It might be added that they are also in use on the similar plant of the Western Union Company and that of the Gold and Stock Telegraph Company in Broad street.

Buehler & Bateman.

This firm, of 2 West 14th street, have been very busy of late in connection with work of which they have made a specialty—that of marine electrical engineering. They did the work lately mentioned on the "Sagamore," as well as on the "Electra," the steam yacht of Commodore Elbridge T. Gerry, of the New York Yacht Club, and on the United States cruiser "Chicago," where the difficulties were unusually numerous and great. They have lately taken also another departure in electrical work, and are now installing the plant for the Sprague electric road at Akron, Ohio, to be driven by four Edison dynamos and to have 6½ miles with overhead conductors. They have been given an order just recently for what, when completed, will be the largest marine plant in American waters. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Aug. 13, 1888.

Personals.

Col. S. A. Barton, vice-president of the Thomson-Houston Electric Company, whose headquarters have been in Chicago for some time past, is now making a short business visit to this city.

Messrs. A. H. Eddy and A. D. Newton, of the Eddy Electric Company, accompanied by their traveling representative, Mr. M. E Baird, were in Boston last week. During the Edison Convention at the Hotel Nantasket these gentlemen exhibited one of their company's motors and the new speed indicator. The working of the handsome and efficient machine and useful little indicator attracted a good deal of attention, and elicited favorable criticism.

Mr. J. W. Godfrey, general manager of the New York Insulated Wire Company was on a business visit to the "Hub" during the past week. Availing himself, as usual, of his opportunities, he made his headquarters at the Hotel Nantasket, Nantasket Beach, while the Edison convention was being held there, and exhibited to the Edison electric light superintendents the various styles of the popular Grimsbaw wires and tape.

Mr. Wm. E. Stow, of long and varied experience in the electric motor field, and whose face is familiar to nearly every electrician and electric light superintendent in New England, has accepted a position with the well-known firm of Sawyer & Blake, Boston. Mr. Stow will hereafter assist in the development of the Sprague electric railway and motor business in the New England States.

Mr. Geo. W. Davenport, of the Thomson-Houston Electric Company, has been enjoying a few weeks' vacation at Camden, Me., where he will obtain a much needed rest from his arduous duties.

Mr. Chas. B. Davis has just returned to Boston after an absence of several months. Mr. Davis has been looking after the interests of the Thomson-Houston International Electric Company in Guatemala, South America.

Mr. Louis J. Magee, who recently returned to the "Hub" from Guatemala, S. A., where he represented the Thomson-Houston International Electric Company for upward of one year, is now permanently located at the executive offices of the company named, at No. 178 Devonshire street, Boston.

New Electrical Goods.

The new style annunciators recently put on the market by the Electric Gas Lighting Company, 35 Arch street, Boston, are meeting with a ready sale. They contain the same working parts as the well-known style "A" Tirrell gravity drop annunciators, which fact is an assurance of the utmost reliability of action, while the cases are neatly gotten up in oak, cherry and black walnut. These annunciators, which are designated as style "A 3," are fully meeting the demands of the trade for serviceable yet low-priced instruments. This company is also making a great run on its "Victor" iron back and "standard" iron frame bells; all its manufactures taking high rank for quality of workmanship and elegance of finish.

The Wainwright Heater.

The Wainwright Manufacturing Company, of Medford, Mass., reports a good business for July and the first week in August. Its feed-water heaters and filters, of which it manufactures a number of different styles, give perfect satisfaction wherever introduced, and the demand is rapidly increasing. Over fifty electric light companies are now using this make of heater, and the company is daily in receipt of inquiries and orders from new plants. These heaters are fitted with corrugated copper tubing, thus allowing a greater proportion of heating surface, strength, and capacity for expansion and contraction. The company reports the following sales of heaters made recently: Mechanics' Falls, Me., 4; Chicago, Ill., 12; Yarmouth, N. S., 1; New Britain, Conn., 2; Portland, Me., 1; Westfield, Mass., 1; Springfield, Mass., 1; Fitchburg, Mass., 6; Bridgeport, Conn., 1; Concord, N. H., 1; Norwalk, Conn., 2; Philadelphia, Pa., 3; Cambridge, Mass., 2; Taunton, Mass., 2; Athol, Mass., 1; Bristol, Conn., 1; Boston, Mass., 6; Montreal, Can., 2; New York City, 3; Lowell, Mass., 2; Cleveland, Ohio, 3; St. Louis, Mo., 1; Canton Junction, Mass., 2; Pittston, Pa., 1; New Rochelle, 1; South Wilmington, Conn., 1; Leominster, Mass, 1; Hartford, Conn., 1; Buffalo, N. Y., 1; Somerville, Mass., 1; Fall River, Mass., 1; Lynn, Mass., 1.

Another Armington & Sims Factory.

The Armington & Sims Engine Company, of Providence, R. I., whose recent removal into its new and extensive factory build-

ings was reported in my notes, has again been compelled to enlarge its manufacturing facilities and is now erecting another factory on its premises. The addition to the main building covers an area 10,000 feet square, used for erecting of the largest type of A. & S. engines. This involves an additional outlay of over $40,000 for new machinery. Among the new machines are eight lathes and a large amount of special machinery from the young and enterprising Providence firm of Messrs. Nicholson & Waterman, who had previously furnished part of the new equipment of the A. & S. factory.

The Armington & Sims Company have just completed a double engine, with dynamo attached. It will drive the machine direct without belting. This is for the new cruiser "Boston," recently finished at the Brooklyn, N. Y., Navy Yard, and now under sailing orders. Duplicate orders have been received for the same type of engine and dynamo combined for the cruiser "Baltimore" and the torpedo station at Newport, R. I. Other orders are: Eight additional engines of 150 h. p. each for the Richmond, Virginia, Electric Railroad; two of 200 h. p. each for the West End Electric Railroad, Boston; three additional of 150 h. p. for the Allegheny City, Pa., Electric Railroad. The output of engines during the past three months has averaged 100 h. p. per day.

Revere Electric Railroad.

An adjourned hearing on the petition of the Revere Street Railroad for location of tracks on Ocean avenue, Crescent Beach, was held last week. Abutters had been notified, and a large number were in attendance, and but little opposition was manifested. The location was granted by the selectmen, and workmen commenced at once to make preparations for passing over the disputed crossing. Immediately after the injunction was issued by the Supreme Court on Tuesday, laborers were put to work to restore the tracks that had been torn up by the Boston, Revere Beach & Lynn Railroad, and at 11:45 o'clock that night the electricians were at work on the overhead wires, and work was also pushed forward in laying rails over the narrow gauge track. The road is probably running to the pier by this time.

West End Electric Railroad.

Mr. Elias E. Ries, of Baltimore, has recently been over the proposed electric railway line of the West End Street Railway Company, of this city. This line is mainly suburban, running along Beacon street from the city proper to Beacon Hill Reservoir, a distance of 3½ miles, through what will probably be the finest thoroughfare in Boston, when the improvements now under way are completed. Mr. Ries recommends as the most advisable form of overhead conductor for this line a light, rigid and ornamental single-post continuous-girder or channel conductor arranged to furnish current to the cars on both tracks by means of brush or trolley collectors making contact with the overhead girder at either side. This plan seems to him to possess a number of advantages, especially for a road of this description, and, in addition to its permanent and ornamental character, obviates nearly all of the objections incident to the use of the ordinary overhead wire for electric railway work. The cost of such a system will be slightly more than that of the usual overhead wire; but Mr. Ries claims that the numerous mechanical and electrical advantages to be derived therefrom are such as to more than repay for the slight additional first cost.

The New Malden Station.

On Thursday evening last the Malden Electric Light Company received their friends for the inspection of their new station, the equipment of which has just been completed. Mr. Royce, general manager, and Mr. A. E. Bliss did the honors of the occasion, and pleasant refreshment was provided. Among those present were: Prof. Elihu Thomson, Messrs. J. N. Smith, C. H. Newhall, and B. F. Spinney, of Lynn; also, Mr. Chas. C. Fry and Mr. Pritchard, of the Lynn Electric Light Company; committees from the City Council of Malden and selectmen of Melrose and Everett; Mr. Jarvis, of the Jarvis Engineering Company, and Messrs. Patterson, Felton and Magee, of the Thomson-Houston Electric Company, Boston. The Malden station is the supply centre for a large and rapidly increasing lighting district, which includes the adjacent towns of Melrose and Everett. Its steam plant comprises three 125 h. p. Whittaker boilers set with the "Jarvis Setting," four 80 h. p. Armington & Sims engines, and the latest and most efficient damper regulator, condenser, pumps, gauges, heater, pipe-covering, etc., etc. The electrical equipment is of the Thomson-Houston system, and is made up of four arc-light machines, one 400-light direct incandescent, and two 500-light alternating current dynamos. In the public street lighting of Malden and its environs the gas has been displaced by both arc-lights and the Thomson-Houston street system of alternating current incandescent lamps of 25 c. p., there being 360 of these small lamps in use at present in addition to the arc system. "Simplex" wire of high insulation is used throughout on all the circuits and forms a valuable feature in the efficiency of this plant. Thomson motors are also being operated from this station, one in the City Hall operating a ventilating blower. The dynamos as well as the engines, are placed on deep and solid stone foundations. The building is of brick with a heavily trussed roof, and is so well proportioned and so roomy that the machinery is not in the least crowded. All wires are concealed and the lines are provided with lightning arresters. The uniformity, the clean, well-finished, nicely adjusted and systematized arrangements from the boiler room to the office, and the perfect running of all the machines, make this station a model of its kind and assure reliable and efficient lighting service for Malden and vicinity. In their attainment of such highly satisfactory results Messrs. Royce & Bliss have had the services of Messrs. Crocker and McElroy and Plaisted as electricians.

Telephone Tattle.

The Boston *Transcript* says: "Bell telephone earnings for June are said to show an increase of 60 per cent. over June, 1887, while the gain for July is placed at over $100,000 in comparison with the same month last year. Earnings now are stated to be at the rate of 28 per cent. per annum on Bell stock."

A New Telegraph Line.

Advices from Rockland, Me., dated Aug. 2, report that at the adjourned hearing at Augusta yesterday, upon the petition of the Postal Telegraph Cable Company, the railroad commissioners decided that the petitioners' prayer to construct a telegraph line from Mattawamkeag to Vanceborough should be granted. The line is now being constructed. The Maine Central Company had objected to its construction, and at the hearing presented objections, viz., that additional poles and wires would be an obstruction to the vision of engineers and in the way generally. The board determined that the company should erect the line between the points named, subject to reasonable limitation as to location as the Maine Central may impose. The same company are establishing a line between Vanceborough and Halifax.

The Girder Rail.

Here we have a product which is destined to find favor with and general adoption by street railway companies throughout this country and abroad, and more particularly those companies who operate electric motor cars. The Providence system of girder rail was jointly invented and patented by the late Mr. Lodowick Brayton and Mr. D. F. Longstreet. The rail is seven inches deep and weighs 54 pounds to the yard. It combines the maximum of strength with the minimum of weight, and can consequently be laid more cheaply than any other rail of equal wearing surface. It will support a car loaded with 80 tons. The track is composed entirely of iron and steel. The joints are perfect and can neither separate nor settle. The rail is now in use on the street railways in the following cities, viz.: Providence, R. I.; Pawtucket, R. I.; Lowell, Mass.; St. Paul, Minn.; Kansas City, Mo., and Des Moines Ia. The West End Railroad Company of Boston has just ordered upward of 650 tons of the girder rail for use in its electric railway system. The name of the corporation which manufactures this valuable product is the Providence Girder Rail Company, and the factory is located in Providence, R. I.

The Edison System.

After a trial of the Edison and another incandescent systems of electric lighting for a period of two years, the Boston Rubber Shoe Company has ordered from Messrs. Paine & Francis, New England agents of the Edison United Manufacturing Company, a 1,500 (16 c. p.) light isolated plant for lighting its factory No. 2, at Middlesex Falls, near Malden, Mass. This plant is now being installed, and the New England Wiring and Construction Company, of Boston, has charge of the wiring and construction work. This makes the second installation of the Edison system made by Messrs. Paine & Francis on the property of the Boston Rubber Company, the first plant (1,200 incandescent lights of 16 c. p.) being located at the company's factory No. 1, at Malden, Mass. Messrs. Paine & Francis have in hand two other orders for the Edison system of incandescent lighting, viz.: An increase of 115 lights (16 c. p.) at the paper mill of Messrs. Hollingsworth & Whitney, at South Braintree, Mass., and an increase of the plant at the mills of the York Manufacturing Company, at Saco, Maine, from 375 (16 c. p.) incandescent lights to a capacity of 1,800.

The Simplex Wire.

The manufacturing facilities at the factory of the Simplex Electrical Company have been increased recently, and ten miles of this wire per day has been the product during the past fortnight. The company has purchased a plot of land in Cambridge, Mass., and will begin at once to break ground preparatory to erecting a large factory. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Aug. 11, 1888.

Subway Litigation.

The Keystone Light and Power Company has gone into court in order to compel the City Council to give it a hearing on its desire to get an ordinance, so that it may go ahead with its work The Penn Company, which controls the underground system, is alleged to be at the back of the opposition now encountered by the Keystone Company, and it is known to have fought that company bitterly at every point. A special investigating committee on the subject was appointed, but so far no report has been made.

A Neat Little Yacht.

Mr. G. W. Lord, the well-known manufacturer of Lord's Compound, long appreciated by steam users, has a beautiful yacht, the "Lulu May Lord," 40 feet keel, 12 feet in breadth, and a depth of 7 feet, with eight berths and a state-room for two. She is tastefully and luxuriously fitted throughout. Mr. Lord enjoys his trips, and if any electrical men want to hire the boat he will make excellent terms with them for her use.

Cutting Glass by Electricity.

The following is from the *Pittsburgh Dispatch*: Several of the South Side glass factories are now using electricity for a novel purpose. Heretofore when they wanted to cut one of the large cylinders of window glass a simple but primitive method was used. This consisted of the pulling out from the furnace of a thin shred of glass heated white. This was quickly wrapped around the bottle-shaped end of the cylinder, and it burned through or fractured the glass. A pair of tongs had to be used in the process. By the new method the glass cylinder is encircled with a fine wire, the extremities of which are put in connection with a small electric battery. It is necessary that the wire adhere closely to the glass. When a current of electricity is passed through the wire latter becomes red hot and heats the glass beneath it. Then a single drop of water deposited on the heated place will cause a clean breakage of the glass clear around in the path of the wire. Contrary to what takes place with the usual process in the treatment of this fragile material, it is found that the thicker the sides of the cylinder are the better the cut.

Aluminum Alloys.

The following item from *Iron* seems of more than ordinary interest: There have been several announcements recently, both in this country and in England, of discoveries of methods of producing cheap aluminum. Still, the new metal is not commercially cheap, nor have any of these discoveries so far materialized as to give to the world a supply of this wonderful metal. There is a concern operating quietly in Jersey City, who, without making any announcement of a discovery, are now producing cheaply two valuable alloys of alluminum and iron, one for use with cast iron and one for steel. The former is called alluminum-ferro-silicon, and the latter ferro-aluminum. These alloys have already been widely used, and are proving of great value in foundry practice, and a considerable demand has sprung up for the product from iron and steel works in various parts of the country. The statement is made that when this aluminum-ferro-silicon is used in the proportion of ten pounds to every ton of molten iron, it greatly improves foundry practice. It is used in the ladle, and the metal is poured upon it without stirring. It cleanses the metal effectually by reducing oxides, and renders it very fluid. It gives life to the metal, raises its setting point and lowers its chilling point, so that castings take form quietly, while the thinner parts are not so apt to be hard and brittle, or cracked by the shrinkage caused by sudden changes of temperature. Being more fluid, sharper castings result, and under the tool are found to be softer and their strength is also increased. The percentage of defective castings in any foundry is a vexatious loss, and as they are but scrap, that has cost the price of the regular pig, there seems to be no doubt that this new alloy, which lessens this large percentage of loss to the founder, and gives him such improvement in his practice, will find large and increasing demand. This loss by defective castings was thus stated by a prominent stove concern which had figured it: "*Every pound of faulty casting takes the profit on eight pounds off of good castings to make the loss good.*" To lessen this loss, as well as to give sharper, stronger and softer castings, without blow-holes, is the mission of this new alloy, and an important mission it is. The alloy is sold for ten cents per pound and its use in the very small proportion to the ton of iron named above gives results of such trifling additional cost that it will find its way to very general foundry use, and the announcement of it should be of interest to the entire iron trade of the country. E. W. E.

The "Electric Building"

is the name of the new salesrooms and factory of the Novelty Electric Company. It is a prominent feature of North Fourth street and stands for Nos. 50, 52 and 54. It is five stories high, well built throughout. The company occupy the main floor for salesrooms and the second floor for manufacturing. The remainder is let out with power. The company are busy with all their usual lines and propose to undertake the most difficult experimental work that may offer. They expect to go into the production of electric motors on a large scale.

National Electric Company.

This company, of 1,231 Filbert street, are doing an excellent business in the installation of electric gas lighting plants, in connection with electric bell, burglar alarm and annunciator outfits. They are also doing a large amount of wiring for incandescent lighting. Mr. Worrell, the manager, has had large experience in this department of the business, and his work is to be found in some of the finest residences in the city.

Baxter Motors.

Mr. McCarthy, representing the Baxter Company, of Baltimore, was in the city this week and had a long interview with the company's Philadelphia representative, Mr. H. A. Cleverly, of 1,018 Chestnut street. The Baxter motor is already well liked in this city, and these gentlemen now propose to have it thoroughly introduced among the manufacturers before the winter season sets in. At his large establishment Mr. Cleverly exhibits a full line of these motors, where they can be seen in operation. Mr. Cleverly meantime is very busy turning out large quantities of his special automatic argand and other electric gas-lighting burners, and every department of his factory is in full activity.

The Spellier Time System.

Pinkham & Cutler, at 1,018 Chestnut street, report themselves as busy introducing electrical appliances of all kinds for home, office and factory. They have recently taken up the Spellier time system, which has already been described in your columns and is well known to electricians, and they expect to find ample patronage for it.

Moore's Insulated Wires.

Mr. A. F. Moore's insulated wire factory, Third and Race streets, Philadelphia, has received a new 100 h. p. boiler and 90 h. p. Corliss engine of Jacob Naylor's make. Increasing demand for the product of the factory has necessitated this increase in power. The average weekly output of the factory, I am told, is, even now, over three tons of insulated wires and cables, and, of course, it runs much higher in busy times.

Partrick & Carter.

Mr. C. M. Wilkins, of Partrick & Carter, has just returned home after a successful trip through no fewer that 27 States. His reception among the electrical fraternity everywhere was warm and hearty, as well it might be when it is remembered that the firm dates back to almost the very beginning of electrical business in this country. I never enter their fine salesroom without finding some extension of the business going on. They now carry in stock the most complete line of household, office, telegraph, telephone and electric light supplies, and they claim to be able to fill at short notice the largest order of any kind that can possibly come in. They are now making a new skeleton bell of unusual merit, and are ready to receive orders for it.

The Pechin Dynamic Belt.

Mr. J. W. Pechin & Brother are the makers of Pechin's dynamic belt. This is already known to a great many electric light people. This belt undergoes some kind of special secret process, and is peculiarly successful in resisting all dampness. Hence, for running high-speed engines at the seashore, it has been in great demand. It is made in single or double belts, the double being cemented, and the cement being water acid and oil proof. The belt is remarkably flexible and strong, and will not stretch or twist out of shape.

A New Dynamo.

Passing down North Fourth street, and glancing into a window, I saw what I took to be a well known motor running, but upon close examination I found that my hasty conclusion was wrong. The plant consisted of a Climax dynamo, run by a Climax engine, both of which are somewhat original as to details of design.

The Thackara Manufacturing Company.

The above concern, of 1,300 Chestnut street, are well-known to makers of electroliers and electric light fixtures. They are now, as already mentioned, fitting up the Union League Club-House with their productions, and I understand that some of the electroliers will cost as much as $1,000 a piece. The designs are very beautiful and elaborate. The company are also fitting up the new

Drexel building at the corner of Chestnut and Fourth streets, and the fine place of Darlington, Runk & Co. They have also recently supplied some very handsome hammered fixtures for the offices of Westinghouse, Church, Kerr & Co., in New York, and I dare say that the specimens of their work in the New York Electric Club are familiar to most of your readers. Their salesrooms contain a rich display of these fixtures, with cut glass globes and imported shades in beautiful designs.

W. T. H.

WESTERN NOTES.

Branch Office of The Electrical World,
44 Lakeside Building, Chicago, Aug. 11, 1888.

Motor Progress.

Mr. F. N. Armour, manager of the Chicago branch of the C. & C. Motor Company, informs me that he has sold about 30 fan outfits with motor attached since July 1, and has a bright prospect for the sale of many more.

Natchez, Miss.

An electric light company has been organized at Natchez, Miss., which has just purchased of the Van Depoele Electric Company, of Chicago, sixty 2,000 candle-power arc lights. The plant is to be operated as a central station.

Sperry Electric Company.

Mr. D. P. Perry, vice-president and general manager of the Sperry Electric Company, informs me that his company are getting thoroughly organized and ready for aggressive work in the manufacture and sale of their electric light system. The officers of the company are S. P. Parmly, president; D. P. Perry, vice-president and general manager; E. E. Crepin, treasurer; secretary, George H. Bliss; electrician, Elmer A. Sperry. The capital stock of the company is $250,000, the majority of which has been placed through the efforts of Mr. G. H. Bliss. The company have a solid financial backing, as the names mentioned are known as those of men of wealth. The manufacture of apparatus will be commenced at once at their factory, 194-198 South Clinton street, where they are putting in such machinery as is necessary, and they will employ a good force of men to start with. The lamp, it is claimed, has been greatly improved, and the company will now be prepared to supply both high and low tension lamps, from 10 to 20 ampères.

Fort Worth, Tex.

The 300 light isolated plant, Westinghouse system, installed by the Marr Company, at the Texas State Penitentiary, Rusk, Tex., has now been in operation a little over a month and is giving perfect satisfaction. The engine and dynamo are located in one of the old shops, whence the current is distributed to all parts of the institution, hospital, cells, offices, furnace yard and around the outside walls. The State officials, in their acceptance of the work express themselves as highly gratified with the installation. The Fort Worth Electric Light and Power Company's Westinghouse alternating plant is nearing completion. Over 250 poles are already up, nearly all having been set in solid rock. A greater part of the business houses, several residences and all the principal hotels are already wired for the light. The building for the station is located on the Texas Pacific Railroad, near the Fort Worth Iron Works, and is to be a fire-proof structure, 45 ft. by 109 ft. It will contain four steel boilers, three Westinghouse alternating machines, and one 50-light arc. The Beck automatic engine will be used. The machinery is all expected in a few days, and it is the intention to "light up" on Sept. 1. The Marr Company are also at work upon a 1,300-light plant in Gainesville, Tex., of the Westinghouse alternating system, which will be completed some time in September. Several other plants are in view. N. Marshall, of the Marr Company, is in charge of the Texas work at present.

Bowsher's Speed Indicator.

Bowsher's speed or motion indicator—advertisement of which appears in your pages—is now used in a great number of electric light stations, both steam and water power, and everywhere is reported as being a highly satisfactory addition to the plant. It is not a new or untried device by any means, hundreds having been in use for several years past, on almost every conceivable class of machinery where a uniform motion is desirable. The indicators are very reasonable in price, will last a lifetime, and users of electrical machinery should write the manufacturers for trial terms and discounts.

Electrical Woodwork.

Electricians recognize the difficulty in obtaining substantial woodwork, that is of thoroughly seasoned wood, and secure joints and corners. This difficulty often arises from having their work done in ordinary factories where there is a large variety of work, especially large work in which all defects may be covered in finishing. Such work after a little use only causes customers trouble and reflects on the house furnishing the appliances. The H. C. Underwood Manufacturing Company, of Wabash, Ind., manufacturers of all kinds of woodwork for electricians' use, offer this advantage, that they make only this class of work, and consequently give it the care which insures entire satisfaction to all.

The Cincinnati Centennial.

The following is from the Cincinnati papers:

Mr. Wm. J. Hammer, the electrical expert, not content with the wonders of his electrical effects, the fame of which is being spread abroad, is preparing a novel and unique exhibit that simply caps the climax.

It is a mammoth Edison electrical globe, composed of 15,000 of the regular electrical globes. This exhibit will be nearly 30 feet high. It will glow as one colossal lamp of 100,000 candle-power. It stands on a base of about 3,200 globes that will gleam pure white, except where the word "Edison" will flash and glow in colored effects.

There is the immense socket 3 feet high upholding the great globe inclosing the myriad of smaller ones. From this great globe, which resembles a balloon, will come a soft radiance of colored lights, whose effect will be simply entrancing.

At the front, just over the base, in tablet form, is a shield which will gleam in red, white and blue stripes, and the stars in blue field. On this shield will be the inscription in infinitesimally small globes of lettering, "Exhibit of Edison Lamp Company, Harrison, N. J., employing nearly 15,000 Edison lamps and illustrating the capacity for manufacture of the factory per twenty-four hours. Designed by Wm. J. Hammer." The electrical performance by Mr. Hammer is now regularly billed as one of the great features of the exhibition.

Lafayette, Ind.

Mr. J. T. Davidson, president and general manager of the Brush Electric Lighting Company, of Lafayette, Ind., was in the city this week. He tells me that his company now have in operation 350 arc and 600 incandescent lights. The installation of the Opera House with 160 Brush-Swan incandescents has just been completed and is working finely. The company are making preperation to put in a new incandescent plant in the residence portion of the city. For a distance of from 900 to 1,000 feet they contemplate using the direct two-wire system and outside that the alternating system. This they think will be the most economical way of lighting the territory. Work on the new electric road, Sprague system, he informs me, is progressing fast and it is hoped to have it completed next month.

A New Electric Light Company.

License of incorporation has just been granted by the Secretary of State to the Normal Electric Light Company, of Normal, Ill. Capital stock, $25,000. Incorporators, M. T. Burwell, C. L. Gill, M. C. DeMotte, O. Seibert and Charles DeGarmo.

Personal.

Howard L. Douglass, of K. P. fame, the receiver of the Hauss Electric Company, regarding which I sent you full particulars at the time, is non-committal as to the future policy of the company, but it is generally believed there will be a reorganization just as soon as matters can be straightened out.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$150@$155		Iowa Union	$27@	$28
Central Union	47@	48	Michigan	79@	80
Chicago	345@	360	Missouri and Kansas	70@	71
Colorado	44@	47	Rocky Mountain Bell	40@	45
Cumberland	65@	68	Wisconsin	110@	112
Great Southern	35@	40		E. L. P.	

SOUTHERN NOTES.

Dallas, Texas, Aug. 2, 1888.

New Orleans, La.

The Louisiana Electric Light and Power Company, of New Orleans, who recently purchased the plant and franchise of the local Brush Company, are using their best efforts to bring order out of the chaos that existed after the recent fire in the station. The Westinghouse Company will replace the machines and apparatus that were burned, which will allow them to go on and light where the Westinghouse formerly lighted. The transaction leaves the company without a competitor in the arc lighting business, but it is understood that the present rates will be maintained.

Shreveport, La.

The engines and boilers for the new electric light plant at Shreveport, La., have arrived and the work of erection goes on. It is expected that the plant will be in operation shortly in the new quarters.

Natchez, Miss.

A Citizens' Electric Light Company has been organized at Natchez, Miss., with Louis Balto as president, A. Moses vice-president, and A. G. Campbell treasurer. The capital stock is limited to $25,000, and has all been taken. The company is composed of the merchants and business men of Natchez and they expect to have everything going shortly. They have applied for a franchise and the work will be pushed to an early completion. The system to be employed is that of the Van Depoele Electric Manufacturing Company.

The Telephone in New Orleans.

New Orleans is agitating the subject of a reduction in its telephone rates, and the question threatens to assume an aspect similar to the late war on the same subject in St. Louis.

Dallas Items.

The Queen City Electric Light Company of this city has finally awarded the contract for its plant, the Ft. Wayne-Jenney Company being the successful one, using the Slattery induction system. The erection of the plant will be begun at once, the station being very near completion. They will be in operation Oct. 1, according to the conditions of the franchise granted them.

Dallas has been troubled of late with midnight prowlers, and consequently burglar alarms are in active demand. Clower & Harris report an increasing business in that line, which makes it rather lively for them. The various lines are receiving their attention though, and they report the outlook as exceedingly promising.

The Bell Company has one pole in this city that has the astonishing number of 846 wires on it and only a 90 foot pole at that. If any city can beat that Dallas is willing to throw up the sponge.

Mr. Seth Miller, the popular manager of the Electric Light, Power and Manufacturing Company, has returned to Dallas after an extended trip in the interests of his company to the North and East. Matters under his efficient management will take a forward movement as a result of his trip, as all the latest improvements will be used in the new station of that company.

ENGLISH NOTES.

London, Aug. 1, 1888.

Electric Lighting Schemes in London.

A very important step has just been taken with a view of consolidating the electric lighting interests in the metropolis. In the early part of the present year an organization calling itself the South Metropolitan Electric Supply Company was quietly floated; the shares were not offered to the public, and no one knew exactly who was at the back of it. Notices were, however, served upon all the local authorities in the central districts of London that applications would be made to Parliament for provisional orders. These orders have not been obtained, so far as relates to the districts immediately north and south of the Strand, but in Whitehall and Westminster the ground was already occupied (theoretically, if not visibly) by the St. James and the Pall Mall Electric Light companies, and by the Whitehall Company. It is now announced that all four of these concerns have been amalgamated, and will henceforth be known as the Metropolitan Electric Supply Company. From the names of the directors, which have just been published, it is apparent that the scheme is in good hands, both technically and financially. Among other names, I notice those of Sir John Pender, K. C. M. G.; Sir James Anderson, Sir George Elliott, Mr. J. C. Parkinson, and other well-known financiers. The technical element is represented on the board by Mr. J. B. Verity and Mr. J. E. H. Gordon (the electrical engineer to the Whitehall Company). Sir William Thomson, Professor Forbes and Dr. John Hopkinson have accepted the appointment of consulting engineers. The company has secured extensive premises at the south end of Waterloo bridge, where it is proposed to put in plant for at least 150,000 lights. The station will be admirably situated as regards coaling and water facilities, and the Charing Cross railway bridge, which crosses the river at an acute angle with the Waterloo bridge will afford a second route for the wires across the water into the heart of the most important district. Not content with this, the company have also secured a piece of ground in the neighborhood of Lincoln's Inn Fields, where, however, one of the small central lighting stations of the Pilsen Joel Company is already in existence. Although I am not in possession of any direct information on the subject, I think it may be taken for granted that the last-mentioned company will also be bought up. This intelligence may be considered the most satisfactory for the immediate prospects of electric lighting in London that I have had at any time to communicate. Further westward another re-arrangement of the affairs of an electric lighting venture has just been announced, and though upon a smaller scale, it starts with equally good prospects of success. The Chelsea Electricity Supply Company, which was founded in November, 1884, has just been floated with a capital of £100,000. Contracts have already been made for the supply and erection of boilers, engines, dynamos, etc., and for the laying down of main cables. Several influential companies such as the Anglo-American Brush, and the Electrical Power Storage are very closely identified with the scheme, and a strong board has been secured. The district to be supplied is practically the same as that supplied by the Cadogan Electric Light Company, which I mentioned in my letter of a week or two ago.

The Proposed Electrical Section of the London Chamber of Commerce.

In furtherance of the scheme for establishing an electrical section of the London Chamber of Commerce, a well attended meeting was held at the offices of the Chamber, at Botolph House, Eastcheap, on Friday last. A considerable number of members were enrolled and a provisional committee was appointed to consider the details of the organization. The committee was instructed to report to another meeting to be held about the 15th of September.

Electrical Firms and the Paris Exhibition.

I am sorry to say that at the present moment it seems likely that the English electrical firms will not make much of a show at the Paris Exhibition next year. A strong effort has been made by the representatives of the English executive committee to induce those interested to take the matter up, but very little response has hitherto been met with. In connection with the paucity of the electrical exhibits at Glasgow, this appears to indicate that electrical people have have had enough of exhibitions at the present time.

The Cable Rates.

The protracted negotiations between the cable companies with regard to the proposed alteration of tariff were brought to a conclusion on Monday last, when the French company announced their intention to accept the shilling rate. There was, of course, no question of this company blocking the way, but they could not formally consent to the alteration until they had received permission from their government.

The Water Jet Telephone Transmitter.

One of the electrical papers published last week a very detailed account of Bell's water jet telephone transmitter, which, I understand, is about to be introduced here on a commercial footing. As this ingenious instrument is of American origin you are probably fully acquainted with its mode of action. However interesting from a theoretical point of view, it is difficult to suppose that it has a commercial future.

Bath.

The Corporation of Bath has accepted the tender of Mr. H. Massingham to supply seventy 6 ampère arc lamps at the rate of £19 17s. 6d. per annum. Mr. Massingham explains that he is able to take the contract at this figure owing to the fact that he has secured the right to use water-power which is advantageously situated in the centre of the town.

Electric Traction in Paris.

I mentioned last week a scheme which had been put before the Paris Municipal Council for the construction of an underground electric railway, and intimated that I did not think it had much chance of being adopted. I now learn that its discussion has been postponed for some months, which under the circumstances is equivalent to rejection. The same fate has befallen the proposition for an overhead line in which Messrs. Julien, Lartigue and Fournier were concerned. This second scheme was of a much less ambitious character, but would have been useful as connecting the Exhibition buildings with the railway going round Paris.

A Correction.

I am indebted to the *Telegraphic Journal and Electrical Review*, of London, for the correction of a slip of the pen which occurred in one of my recent letters. In describing the electric lighting of the carriages on the Great Northern Railway, I attributed the scheme to Mr. Radcliffe Ward, the well known electrical engineer, instead of to Mr. Radcliffe (without the Ward), who is the electrician to the Great Northern Railway Company, and by whom the equipment was designed and fitted.

Electric Lighting of the Adelphi Theatre.

The Edison-Swan Electric Lighting Company has just completed the lighting of the Adelphi Theatre, in which a remarkably good effect has been produced by the employment of incandescent lamps of 250 c. p., arranged at intervals around the dome which covers the auditorium. The installation consists of some 1,500

lamps, which are furnished with current from two Edison-Hopkinson machines, driven by Willans-Robinson engines. An underground cable conveying current to several hundred lights at the well-known Adelaide Gallery restaurant, belonging to the same proprietors, runs from the engine-room to the restaurant, a distance of some 400 yards. I do not know whether the Willans-Robinson engine is found in America, but since its first introduction, some three years ago, this engine has achieved a great success in this country for electric lighting purposes. It is a remarkable machine, with vertical cylinders built upon the lines of marine engines. It is usually provided with an electric governor, and runs with great steadiness and singular freedom from noise or vibration.

The Maxim-Weston Company.

An extraordinary general meeting of this company was held on Thursday last at the Cannon street Hotel, to appoint additional directors. Mr. Hugh Watt, M. P., occupied the chair. The names of five large shareholders were submitted to the meeting and carried unanimously. The chairman then got up and made a speech welcoming the addition to the board, dilating upon the large contracts now in negotiation and prophesying smooth things generally. So far nothing could have been more decorous than the proceedings of the meeting, but after Mr. Klenck had returned thanks for the new directors and the chairman had vacated the chair, owing to the business for which the meeting was summoned having been duly completed, a scene of great confusion arose. Some suggested the suspension of Mr. Hugh Watt, others asked that the investigation committee should receive 100 guineas remuneration for their labors, the meeting ultimately terminating in "the most admired disorder."

THE TELEGRAPH.

Western Union.—It is stated that Drexel, Morgan & Co. have bought 120,000 shares of Western Union in the last six months for European account.

Telegraph Rates.—The Postmaster General has issued the annual circular prescribing rates to be paid by the government for telegraphing for the year ending June 30, 1889. According to the circular there are ninety-one telegraph companies in different parts of the United States which have accepted the conditions of the act of Congress of July 24, 1866, and which are subject to the provisions of the order of the Postmaster General fixing government rates.

Price of Western Union.—The receipts of Western Union test offices for the week ending Aug. 6 were $224,159, against $182,371 for the corresponding week last year, an increase of $41,788. As these test offices represent about three-fifths of the business done, the total increase is about $70,000, as compared with the last previous week. The New York *Indicator* has a long bullish article on this stock, and says that within the next two years it will sell for three figures instead of two.

Pacific Postal's New Directors.—The annual election of the Pacific Postal Telegraph Cable Company was held at No. 1 Broadway, Aug. 7. Four thousand shares were voted unanimously for the following directors: John W. Mackay, of California; William C. Van Horne, Charles R. Hosmer and Sir George Stephen, Montreal; Henry Rose er, Albert B. Chandler, Hector de Castro, Edward C. Platt and George G. Ward, New York. The resignation of Mr. Levi P. Morton as a director was accepted before the election. The board organized by electing officers as follows: President, John W. Mackay; vice president, Hector de Castro; Secretary, John O. Stevens.

A Telegraph War.—A special dispatch of Aug. 8 from Bangor, Me., says: A telegraph war has been commenced in Maine in which the Canadian Pacific Railroad, the Maine Central Railroad, the Western Union and the courts of Maine are all taking a hand. E. S. Williams, acting under orders from the solicitor of the Canadian Pacific, began to build a telegraph line along the Maine Central, over which the Canadian Pacific is to run from Mattawamkeag to Vanceborough, a distance of 60 miles. Then the railroad applied for an injunction, and one has been granted, and an officer is on the way from the attorney-general's office to serve it. Meanwhile the Canadian people began also to build along the New Brunswick Railroad, which they own, and which is on Canadian soil, but here the Western Union came in with another injunction, but the erection of poles goes on just the same.

The Pacific Cable.—A special dispatch from Ottawa, Ont., of Aug. 8, says: Mr. Owen Jones, of Australia, who is promoting the trans-Pacific cable between Canada and Australia, is here. He feels confident the cable will be completed within 18 months. Sir John Macdonald, the premier, has agreed on behalf of the Dominion Government to assist the enterprise, provided the other colonial Governments interested in the matter do likewise. "All that is now required before work is commenced," says Mr. Jones, "is to secure a guarantee of £75,000 per annum, equal to 4 per cent. on an investment of £2,000,000." He expects aid from the British, Australian and Canadian governments, the subsidy from the latter, it is estimated, being between £7,000 and £10,000 per annum. A strong company has been formed to build the cable. The leading shareholders are Lord Folkstone, Lord Miltown, Lord Winchelsea, Sir James Corry, Sir Donald Smith, and Sanford Fleming. A steamer will be sent to British Columbia shortly to expedite the survey in conjunction with the survey now being made East from Australia. Mr. Jones during his stay in Montreal was assured by Canadian Pacific Railway officials that the company proposed putting a fleet on the Canadian-Australian route within a year.

THE TELEPHONE.

Lewisville, Ark.—The Lewisville Telephone Company, with the modest capital of $250, has been found. Mr. O. R. Gordon is the president.

Dayton, O.—The telephone service at Dayton has been severely damaged and crippled owing, it is said, to a cross with the wires of the electric railway.

Sheffield, Ala., has, it is said, risen to the dignity of a modern telephone exchange system, which will be put in shortly.

The Cushman Telephone.—The American Cushman Telephone Company, of Chicago, has issued in pamphlet form a criticism on the decision recently given against it, and in favor of the Bell telephone, by Judge Blodgett.

More Government Suits.—The *Commercial Bulletin*, of Boston, says: "We hear that one of the most active attorneys opposed to Bell in the recent suits at Washington will be added to the goverment counsel in the forthcoming government suit against the American Bell Company."

Telephones for Chili.—With the object of constructing a line of telephone and telegraph from the city of Valdivia, Republic of Chili, through the States of Bolivia, Ecuador and Colombia, and thence to New York City, the Telephone Constructing Company has been incorporated under the laws of this State with a capital of $30,000. This is divided into 300 shares. Charles S. Beardsley, D. Frank Lloyd, and John F. Shelly, all of New York, who are also the trustees, take 100 shares each. The principal office is in New York.

Initials by Telephone.—All people who have occasion to telephone names have had great difficulty in making initials understood. B, C, D, E, G, P, T, and V sound so much alike that to distinguish between them is almost impossible, and M and N also sound very similar. A system used in the *Palladium* office for some time past, and with very satisfactory results when the person at the other end of the wire has understood it, is to give a word beginning with the letter that is the initial in question. For instance, suppose the name is B. P. Smith. A score or more of other combinations have almost the same sound, but if the sender says "B. P. Smith; B for butter and P for pepper; B. P. Smith," there is no difficulty in understanding.—*New Haven Palladium.*

A Telephone Register.—Edward C. Paramore, aged 26, of No. 34 Rittenhouse street, this city, who has been with the American National Telephone Company, of New York, for four years, has, with the assistance of Mr. Bonta, inventor of the Bonta telephone, invented an apparatus something on the order of an audiphone. The inventors have been working on the device for the past four years, and have at last reached what they consider perfection in its construction. The arrangement is contained in a small box, which is placed in proximity to the telephone and connected by wire. No name has yet been given it. A person is called upon the 'phone, and if not present, the person speaking continues the talking, the communication being electrically committed to wax paper within the machine. When the person addressed arrives at the other end of the wire, he notices that a ball has dropped on the apparatus, which indicates that some one has been talking. Going to the 'phone he opens the switch, when all that has been said previously by the person at the other end of the line commences to be heard in precisely the same tone of voice and at the same rate of speed. The sheets of paper are 8 by 11 inches, and can at any time be placed in the machine and the sound be reproduced. The machine will be completed some time next week. Mr. Paramore's laboratory is located at No. 26 Broadway, New York, where he is employed by the company as private electrician.—*Phila Ledger.*

THE ELECTRIC LIGHT.

Brenham, Tex.—A central plant will probably be put in by Mr. Clyde.

Albany, Ga.—An Edison company has been organized at Albany, Ga.

Paducah, Ky.—The Paducah Gas Light Company is to put in both arcs and incandescents.

Covington, Ky.—The Kenton Electric Light Company has asked for permission to put up a plant.

Meridian, Miss., is to have a Westinghouse alternating plant, it is said, through the agency of Mr. W. C. Harris, Jr.

Albany, Ga.—C. Wessalowsky, J. Brown, J. S. Davis and others are putting up an Edison plant of 900 lights of 16 c. p.

Des Moines, Ia.—The Hill Clutch Works are furnishing the power transmission machinery for an electric light plant in this city.

Mt. Vernon, O.—The Hill Clutch Works, of Cleveland, Ohio, are furnishing the power transmission machinery for the electric light plant in this place.

Portland, Ore.—The Oregon City Electric Works have been incorporated at Portland by M. A. Stratton and others, with a capital stock of $20,000.

Newburgh, N. Y.—The Newburgh Electric Light and Power Company has been formed by J. J. Moore and others, with a capital stock of $100,000.

Coshocton, O.—The Coshocton Electric Light and Power Company has been incorporated by H. Hay and others, with a capital stock of $10,000.

Central City, Col.—The Gilpin County Light, Heat and Power Company has been incorporated by A. Rukard and others, with a capital stock of $25,000.

Chicago, Ill.—The South Side Electric Light and Power Company of Chicago has been incorporated by H. V. Harris and others, with a capital stock of $500,000.

Brooklyn, N. Y.—The Pratt Institute has put in a 125 horse-power horizontal engine and a 2 horse-power vertical, both of the New York Safety make, for its electric light plant

San Francisco, Cal.—The Harding Electrical Manufacturing Company, of San Francisco, has been incorporated by O. W. Nordwell and others, with a capital stock of $1,000,000.

The Lowrie-Hall System.—The London *Electrician* states that Hammond & Co., of London, have shipped a plant of the Lowrie-Hall alternating system to this country for a central station.

Lansingburgh, N. Y.—The Union Electric Light and Power Company, of Lansingburgh, has been incorporated by J. K. P. Pierce, A. C. Comstock and others, with a capital stock of $10,000.

Columbus, Ga.—The Chattahoochee Valley Exposition Company are negotiating to have their grounds lighted by electric lights.

Brockport, N. Y.—B. W. Payne & Son, Elmira, N. Y., are building a new 80 h. p. compound horizontal engine for the Thomson-Houston Electric Light Company's new station at Brockport, N. Y.

New York Rules.—The Subway Board has turned the alternating current papers, etc., over to Dr. S. S. Wheeler, its electrical expert, with instructions to prepare rules and regulations governing the use of such current.

Lyons, N. Y.—The Geneva *Courier* has the following pithy little item: "Lyons is bound to have electricity in some manner they can't have electric lights, but her citizens bought 1,000 electric belts of a traveling company in two weeks."

Indianapolis, Ind.—Mr. J. G. Briggs is interested in an ordinance before the city council for electric light privileges. The Thomson-Houston system is proposed. The company will put in 1,500 lights at once if it secures the concessions asked for.

A Ground on the Letter Box.—A lady attempted to put a letter in a street letter box attached to a pole on which electric light wires are strung in Albany last week, but was repelled by an electric shock. A gentleman lifted the lid with a stick and the letter was deposited.

Saratoga, N. Y.—A correspondent in New York writes that the request of the Saratoga Electric Light & Power Company to erect poles in the street has been refused by the trustees. That body is of the opinion that the village should construct a plant of its own.—*Manufacturers' Gazette.*

Pittsburgh, Pa.—A special dispatch from Pittsburgh of August 9 says: The plant of the East End Electric Light Company, on Broad street, was totally destroyed by fire about four o'clock this morning. The loss was $25,000, fully insured. The fire was caused by spontaneous combustion.

Oakland, Cal.—The designs submitted by the Hill Clutch Works, of Cleveland, Ohio, to the Oakland Gas Light and Heat Company have been accepted and they have been awarded the contracts for furnishing the friction clutches and power transmission machinery for their extensive improvements.

Brunswick, Me.—The Brunswick Electric Light Company are entirely rebuilding their system, which will include new power up to 200 h. p., furnished by water with a Holmes wheel. The plant has 100 cells of the Electrical Accumulator Company in use, installed by Mr. H. E. Vining, and giving great satisfaction.

New York Safety Engines.—The New York Safety Engine Company report an increasing demand for their vertical engines for electric lighting. They have just shipped an 8 horse-power vertical to the Thomson-Houston Company, at Memphis, Tenn. and a 5 horse-power vertical to the Brush Company for the steamer "Gardner," La Crosse, Wis., for the search light.

Geneva, N. Y.—The local *Advertiser* says: "Manager Avery, of the Geneva electric light works, informs us that very soon he will have put in the station here a new and more powerful engine and boiler for driving the dynamos, especially for the public lighting. * * * The village is pleased with the system (Brush) and especially pleased with the courtesy of the management."

The American Company.—The New York *Graphic* of Aug. 11 contains the following: Inquiry of the President of the American Electric Manufacturing Co. this morning elicited the gratifying information that the two large creditors which had recently caused the company some trouble and a temporary closing of the factory had been settled with, and that business in all departments would be resumed early next week.

Church Lighting in the West.—A correspondent in the West, representing the Thomson-Houston system, writes us that Independence, Mo., is not the only Western town with a church lit by electricity. He has himself wired and lighted churches at Larned, Kan.; two at Sterling, Kan.; one at Manitou, Col.; and two at Hastings, Neb. In most cases special sunlight clusters are in use, and always with satisfactory results. The church at Larned has had the electrics burning since February, 1887.

Globe Carbons.—The output of the Globe Company, of Cleveland, is stated to be 150,000 per week, and in the Fall they will turn out 300,000 weekly. The stockholders are men of large means, and the company have every facility for keeping up with the times in their branch of industry. They believe that in their carbons they have struck a happy medium, and can offer to consumers a carbon of proper life without sacrificing the quality of the light. Mr. H. E. Hayes, son of ex-President Hayes, is treasurer of the concern.

Auburn, N. Y.—The new president of the Auburn Electric Light Company is Mr. E. W. Wilson, and Mr. R. G. Reilly, late of Lawrence, Mass., is the superintendent. Contracts have been let for a new station building, three new 125 h. p. boilers and new engines to meet an increased capacity of 200 arc lamps, although the increase will be chiefly used in incandescent lighting. The plant is for light and steam heating and will use exhaust steam for heating water for the boilers, effecting a neat saving over the usual modes of heating stations.

Indianapolis, Ind.—The decision as to electric lighting in Indianapolis is a compromise, which, judging from the great talk in the papers, fails to please, as such arrangements generally fail. Bids, it will be remembered, were made by the Thomson-Houston, Fort Wayne Jenney and Brush companies, and virtually covered all the lighting that offered. The committee were generally pledged to gas, however, it would appear, but recommended a contract for 100 Brush lights at $60 per year. This was voted by the city council. The reason why the Indianapolis Jenney Company did not bid is said to be that they have long had an understanding with the Brush Company not to compete for the street lighting of the city.

Good-bye to Gas.—A workman from the gas works was on the round of the city gas lamps yesterday removing their burners and cutting them off as available sources of street illumination. The action was in accordance with an order from the chairman of the street committee of the city council, instructing the gas company that the council would have no further need for the gas-light in the streets, and to cut off the city's supply, beginning

Wednesday night, the first day of the new month. This closes the reign of gas as the public illuminator for Greenville, and leaves for the new and modern Bru h electric lights the duty of filling the thoroughfares with brightness. It is a long jump forward in the march of improvement, and one in which Greenville has led the way in this state.—*Greenville, S. C., News.*

APPLICATIONS OF POWER.

Brockton, Mass.—An electric motor of 25 h. p. is to run the Packard & Grover shoe factory at Brockton.

Danville, Va.—The Danville Street Car Company are to extend their road and have adopted electricity as motive power.

Southington, Conn.—The plant of the Southington & Plantsville (Ct.) Electric Railway will be erected at once, and will be also used for generating electric lights.

Superior to Engines.—Mr. Charles Essig, a well-known Chicago lapidary is using a 1 h. p. Baxter motor. He speaks of it in the warmest praise as "superior to any other form of engine made."

An Optician's Opinion.—Mr. F. R. Colburn, a manufacturing optician of Chicago, says that his Baxter motor is the best power for light manufacturing for four reasons: It is (1) clean, (2) noiseless, (3) compact and (4) cheap. "It has far surpassed my expectations" he writes.

Advantages of Motors.—The great advantage an electric motor possesses is its adaptability over a wide range of uses for power. While it can be made sufficiently large to take the place of a steam engine of comparatively high power, with economy it can also be made small enough to operate the most delicate machinery, requiring but a small fraction of a horse-power. The isolation of motors is another advantage. They can be placed just where they are needed, no shafting being required for the small motors, the attachment being made directly to the machine to be operated. This will be appreciated by a large class of manufacturers operating special machinery, which is run irregularly and without regard to other operations in the same factory. With the extension of electric light service, the more general introduction of these small motors would seem to be inevitable, their value being already widely appreciated.—*Iron Age.*

PERSONALS.

Dr. S. M. Plush, the well-known general manager of the Bell Telephone Company in Philadelphia, has been interviewed on the old story of "telephone deafness," and expressed his opinion, confirmed by the statements of the exchange operators, that the result of use of the telephone was, if any, an improvement in the hearing.

MISCELLANEOUS NOTES.

Columbus, O.—Mr. C. E. Egan is, it is said, to erect a factory at Columbus for the manufacture of batteries and appliances.

The Illinois Phonograph Company, of Chicago, has been incorporated by F. A. Wunder and others, with a capital stock of $1,250,000.

The Electric Refining Company of Jersey City has been incorporated by L. Zimmerman, of Sea Cliff, N. J., and others, with a capital stock of $100,000.

Camden, N. J.—The United Electric Improvement Company has been incorporated in Camden, N. J. It will make electrical appliances at Gloucester. The incorporators are Waldron C. Shapleigh, of Woodbury, and Edward Lee and Randal Morgan, of Philadelphia. The capital stock is $75,000, of which $10,000 has been paid up.

The Gray Telautograph.—Last week we illustrated the ingenious new telautograph system invented by Prof. Elisha Gray. A charter has now been granted in Virginia to the Gray National Telautograph Company. The capital is $500,000 and may be increased to $15,000,000. The offices will be in Richmond. The officers are Thomas M. Logan, Richmond, president; Charles E. Coon, New York, vice-president and director; Charles B. Farwell, Chicago; J. M. Thompson, St. Louis, Mo.; George Hoadley, New York; Joel F. Freeman, New York; Wendell Goodwin, New York; J. B. Pace, Richmond; P. B. Plum, Emporia, Kan.; Eugene Hale, Elsworth, Me., directors; David J. Carson, New York City, secretary; Charles E. Coon, New York City, treasurer. As soon as $600,000 is subscribed the company will commence business. Edward Lauterbach, George S. Scott, James H. Dooley, Calvin S. Brice, John H. Inman, Samuel Thomas, John McAnery, Walter B. Whiting, James M. Ormes and Walter Whiting are also members of the company. Some of the largest capitalists in the country are said to be interested in the enterprise.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos. Send for their price list and catalogue, or write to them stating what you want.

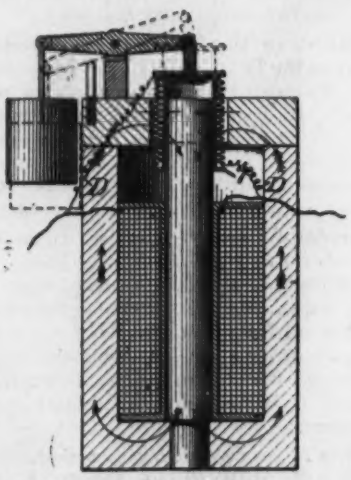
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED AUG. 7, 1888.

387,276. Electric Clock Synchronizer; Arthur G. Wiseman, St. Louis, Mo. Application filed April 17, 1888. Consists in a spring lever fulcrumed to the clock to be regulated, and having its free end in communication with a suitable electro-magnet, combined with the minute-hand toothed wheel, having one side conical and provided with a specially-shaped hub, carrying a toothed plate for gearing into corresponding teeth or holes in the face of the actuating friction disc of the minute-hand spindle, and with a spring or springs, the whole operating so that on the depression of the spring lever by the electric current the minute-hand of the clock is brought exactly to the point of twelve on the dial.

387,310. Electro-Mechanical Movement; Richard H. Mather, Windsor, Conn. Application filed Jan. 9, 1888. The invention is an electrical instrument in which an electro-magnet and a solenoid, which serves as an armature of the same, react upon each other to produce a movement of the solenoid. This instrument is designed to possess great strength and sensitiveness and to manifest a long range of movement with uniform power. See illustration.

(1) 387,316. (2) 387,365. (1) Railway Signaling System; (2) Electric Switch-Lock; Edward L. Orcutt, Somerville, Mass. Applications filed respectively Feb. 7, 1887 and Feb. 9, 1887. (1) The signaling devices carried on the train are placed in the circuit for operation by a magnet located on or near the track, and charged by the same. The arrangement is such that the unimpeded operation of the track magnet will actuate one kind of signals and the failure of that magnet to operate will cause the operation of another kind of signal through the intervention of suitable brushes carried by the train and the contact plates on the road arranged in proper relation thereto. (2) A device whereby a switch after once being locked in a certain position cannot be unlocked or become deranged until the train has passed over.

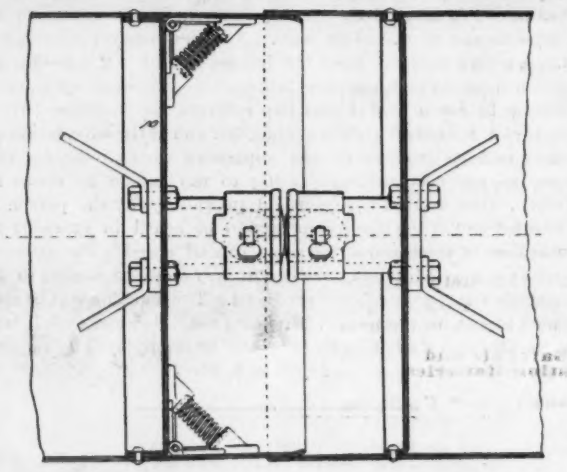


387,310. ELECTRO-MECHANICAL MOVEMENT.

387,343. Dynamo-Electric Machine and Electric Motor; R. E. B. Crompton, London, Eng. Application filed Feb. 23, 1887. Patented in England March 3, 1884, No. 4,302, and and in Belgium Feb. 19, 1885, No. 67,928. The armature is made up of wrought-iron discs, which are supported upon the removable shaft by radial arms, making dove-tailed connections therewith.

387,347. Amalgamator; Adam H. Eysaman, of Dayton, Nev. Application filed June 10, 1887. The vessel contains a series of fluted arms which catch the globules of quicksilver and conduct them to a receptacle in the bottom. The whole mass is charged with electricity in order to concentrate the metallic portions.

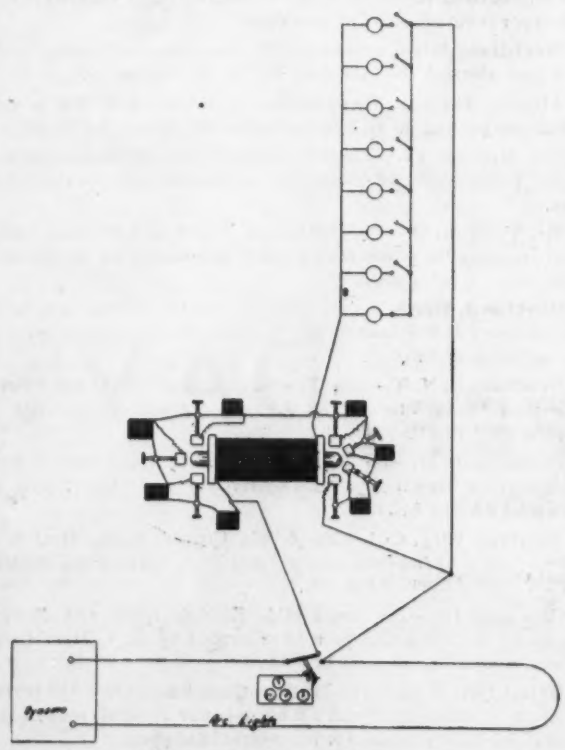
(1) 387,382. (2) 387,383. Electric Railway Systems; David G. Weems, Baltimore, Md., Assignor to the Electro-Automatic Transit Company of Baltimore City. Applications filed March 20 and April 20, 1888, respectively. A motor and a series of succeeding cars adapted for mail and small packages, said cars having one or both ends provided with compressible end wings, whereby the meeting end of one car may enter or telescope with the ends of contiguous front cars. See illustration. (2) The application to the cars of a



387,382. ELECTRIC RAILWAY SYSTEM.

train of folding, collapsible, or other wings adapted to be automatically thrown outward at predetermined intervals to check the progress of the train.

387,432. Armature for Dynamo-Electric Machines; Alexander W. Meston, St. Louis, Mo. Application filed Dec. 7, 1887. A flat ring armature composed of laminated sections, having one or more coils of wire wound on each section, any of such sections being detachable, the sections being composed of alternate short and long fitting, and joined together by means of the tongues and recesses formed thereby.



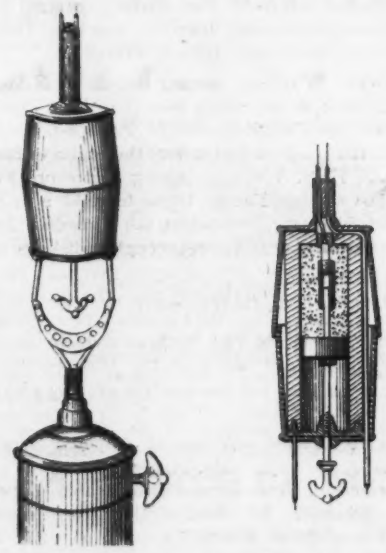
387,615. SYSTEM OF COMBINED ARC AND INCANDESCENT ELECTRIC LIGHTS.

(1) 387,463. (2) 387,464. Electric Regulators; Joseph A. Vansant and Frank S. Anderson, of Easton, Maryland. Applications filed respectively Sept. 5, 1887, and Jan. 21, 1888. The construction and arrangement are such that the normal circuit may be broken at will and the current caused to diverge and pass through a material in a comminuted or powdered condition, and whose relatively low conductivity is increased or dimished at will by compressing it more or less by suitable means provided for the purpose. The compression increases or diminishes the strength of the current, and thereby affects the brilliancy of the light or speed of the machine to which the current is supplied. See illustration.

387,505. Methods of Measuring Electricity; Geo. Forbes, London, England. Application filed March 8, 1888. For description see page 80, this issue.

387,526. Electric Switch; James F. McElroy, Lansing, Mich., Assignor of one-half to L. C. Butler, of same place. Application filed March 17, 1887. A "snap" switch in which the terminals are cylindrical and the movable contact pieces are secured to trailing springs, the latter being connected with a shaft, which is connected in turn with the operating handle. The handle and shaft are connected together with pawl and ratchet and have limited lost motion with respect to each other.

387,585. Auxiliary Fire Alarm Apparatus; Walter J. Dudley, Everett, Mass., Assignor by mesne assignments to Walter J. Dudley, Trustee, of same place. Application filed July 5, 1887. A main motor and its detent and a secondary motor and detent, the secondary motor when operated causing the detent for the main motor to release the main motor, and the detent for the main motor being provided with a stopping device for the secondary motor.



387,463. ELECTRIC REGULATOR.

387,615. System of Combined Arc and Incandescent Electric Lights; Harold P. Brown, Chicago, Ill. Application filed Sept. 29, 1884. The invention consists in combining with the main or high-tension circuit in which a number of arc lamps or other translating devices may be arranged in series, and the local or quantity circuit in which a numer of incandescent lamps or other like translating devices are arranged "in parallel groups," a shunt-circuit furnished with an automatically-variable resistance to compensate for one or any number of the incandescent lamps in the parallel group which at any time may not be in use. If, for example, the system is adapted to operate or burn eight incandescent lamps in each parallel group, when all the eight lamps are in use the shunt-circuit may be open and no part of the current passes through it. When only one of the eight lamps is in use, the amount of resistance in the shunt-circuit is such that seven-eighths of the current will pass through it, and when two lamps are in use the resistance in the shunt-circuit is be varied or increased so that only six-eighths of the current will take that course, and so on. See illustration.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.